May, 1927

Making Steel and Wire— *Illustrated Article*

Catalogue of

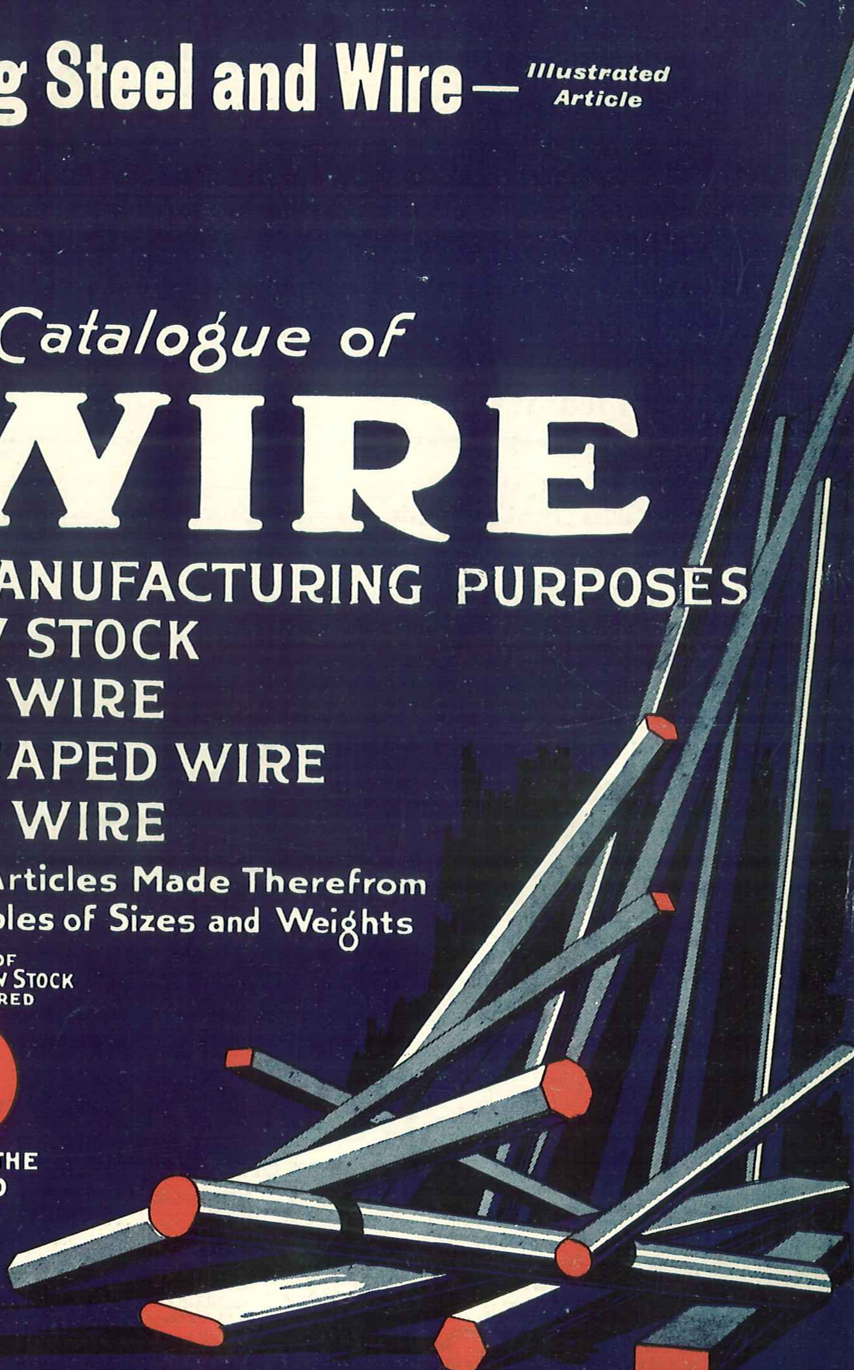
WIRE

FOR MANUFACTURING PURPOSES
SCREW STOCK
PIANO WIRE
ODD SHAPED WIRE
ROUND WIRE

Different Articles Made Therefrom
Warren's Tables of Sizes and Weights

THE ENDS OF
AMERICAN SCREW STOCK
ARE PAINTED RED

LOOK FOR THE
RED END



Made by
American Steel & Wire Company

Cancelling issue of May, 1925.
Subject to change without notice

INDEX

To Manufacturers:

We can draw wire into most all shapes—round, flat, square, oval, star or other odd shape—for the various uses of manufacturing. Some examples of such wires are shown in the accompanying illustrations. We would be glad to have you write us what your requirements may be and very likely we can save you money by furnishing a net drawn form in wire where you may now be spending considerable shop labor in shaping plain bars. Write us about your requirements and we may be able to assist you with specifications and in particular cases figure out a form of drawing either to order or adapt something already drawn.

American Steel & Wire Company

SALES OFFICES

CHICAGO . . . . 208 So. La Salle St.
CLEVELAND . . . . Rockefeller Building
DETROIT . . . . Foot of First Street
CINCINNATI . . . . Union Trust Building
MINNEAPOLIS—ST. PAUL . . . . Merchants Nat'l Bank Bldg., St. Paul
ST. LOUIS . . . . 506 Olive Street
KANSAS CITY . . . . 417 Grand Avenue
OKLAHOMA CITY . . . . First Nat'l Bank Bldg.
BIRMINGHAM . . . . Brown-Marx Bldg.
MEMPHIS . . . . Union and Planters Bank Bldg.

NEW YORK . . . . 30 Church Street
BOSTON . . . . 185 Franklin Street
PITTSBURGH . . . . Frick Building
PHILADELPHIA . . . . Widener Bldg.
ATLANTA . . . . 101 Marietta Street
WORCESTER . . . . 94 Grove Street
BALTIMORE . . . . 32 So. Charles St.
BUFFALO . . . . 670 Ellicott Street
WILKES-BARRE . . . . Miners Bank Bldg.

DALLAS . . . . Praetorian Building
DENVER . . . . First National Bank Bldg.
SALT LAKE CITY . . . . Walker Bank Bldg.

*SAN FRANCISCO . . . . Rialto Bldg.
*LOS ANGELES . . . . 2087 E. Slauson Ave.
*PORTLAND . . . . 6th & Alder Sts.
*SEATTLE . . . . 4th Ave. So. & Conn. St.
United States Steel Products Co.

PREFACE

It takes the demand of the entire world to make us prosperous. Alone we would not succeed. We acknowledge the debt to the widest markets to create demand for, and to absorb our products.

WE PRESENT this Catalogue of the wires we make for manufacturing purposes, and especially treat herein of their application to the general manufacturing trade and give some description of the wide range of use.

We take this occasion to express our gratitude to the manufacturing trade for its patronage in the past and flattering confidence shown in the character of our product. That it has merit is due to the exacting requirements of the trade—that reliability and adaptability are found in our wires, from the common Bessemer for ordinary commercial usage to the exquisite acoustic requirements of the piano, the life-and-death dependability of the airplane wires, or the mathematical exactness of the adding machine or other instruments of precision.

The range of usage is tremendous, and reveals the demands of the highest condition of advanced civilization of the entire world. We here express our obligation to this demand by which only within the last score of years has it been possible for us to market our product.

As every state in our country, as well as abroad, maintains this condition and further progresses by every man from top to bottom carefully developing the habit of industry and accomplishment, so will we further prosper. We cannot hope to sustain this through any merit of the raw materials within our own borders. These are but dumb and useless in themselves—it is the widely distributed intelligence and advance of modern progress in inventive genius and ability to employ, OF THE ENTIRE GLOBE, that creates the countless mechanisms, and usages into which our humble materials enter.

And so, to those thickly populated centers of the east and west and the throbbing marts of the world, we acknowledge our indebtedness and hope for the continuance of world invention and mechanical usage from which we have drawn our prosperity.

Screw Stock

(COLD FINISHED STEEL)

Red End

Standard Classification of Extras

(Subject to change without notice)

We are manufacturers of a superior grade of screw stock, having the principal requisite of free cutting, and drawn close to size. We take great pains with the analysis and drawing, so that manufacturers will secure in this stock the best and most reliable material that can be made.

We also make for manufacturing purposes:

Cold Drawn Steel in many shapes
Roller Bearing Steel
Oil Well Pump Rods
Cone Steel

All Made so as to Meet the Necessary Requirements

Net Extras for Size on Screw Stock

ROUNDS

***In Lengths 5 Feet to 24 Feet Inclusive**

Diameter Inches	Pounds per Foot	Per 100 Lbs.	Diameter Inches	Pounds per Foot	Per 100 Lbs.
1/8	.042	$3.00	2 1/4	13.49	$0.15
5/32	.065		2 5/16	14.00	
3/16	.095	2.00	2 3/8	15.07	
7/32	.128		2 7/16	15.83	
1/4	.167	1.25	2 1/2	16.68	
5/16	.259	1.00	2 9/16	17.55	
3/8	.370	.90	2 5/8	18.32	
7/16	.510	.70	2 11/16	19.31	
1/2	.666		2 3/4	20.18	
9/16	.843		2 13/16	21.15	
5/8	1.05	.55	2 7/8	22.09	
11/16	1.25	.40	2 15/16	22.96	.35
3/4	1.50		3	24.06	
13/16	1.757	.35	3 1/16	24.58	
7/8	2.03		3 1/8	26.09	
15/16	2.34		3 3/16	27.16	
1	2.64		3 1/4	28.24	
1 1/16	3.00		3 5/16	29.40	
1 1/8	3.33	.30	3 3/8	30.43	
1 3/16	3.74		3 7/16	31.50	.50
1 1/4	4.16		3 1/2	32.64	
1 5/16	4.61		3 9/16	33.84	
1 3/8	5.048		3 5/8	35.20	
1 7/16	5.50		3 11/16	36.40	
1 1/2	6.00	.25	3 3/4	37.45	
1 9/16	6.52		3 7/8	39.85	
1 5/8	7.04		3 15/16 to 4 3/8	.....	.80
1 11/16	7.60		4 7/16 to 4 7/8	.....	1.00
1 3/4	8.16		4 15/16 to 5 3/8	.....	1.25
1 13/16	8.78		5 7/16 to 5 7/8	.....	1.75
1 7/8	9.39		5 15/16 to 6 3/8	.....	2.25
1 15/16	10.00		6 7/16 to 7	.....	3.00
2	10.65				
2 1/16	11.15				
2 1/8	12.07				
2 3/16	12.79				

*See list of extras on page 8 for cutting to other lengths.

We make rounds up to 4 1/16 inches (inclusive).

An intermediate size takes the price of the next finer size provided for. Example: For 11/64 inch we charge the same price as for 5/32 inch.

Net Extras for Size on Screw Stock

SQUARES

***In Lengths of 5 Feet to 24 Feet Inclusive**

For Screws, Nuts, Bolts, Keys, Splines and Shafts

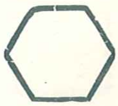
Size, Inches	Pounds per Foot	Per 100 Lbs.	Size, Inches	Pounds per Foot	Per 100 Lbs.
1/8	.053	$5.00	1 3/8	6.39	$0.90
5/32	.083		1 7/16	6.99	
3/16	.119	4.00	1 1/2	7.60	
7/32	.165		1 9/16	8.26	
1/4	.211	2.50	1 5/8	8.93	
5/16	.332		1 11/16	9.63	
3/8	.475	1.75	1 3/4	10.34	
7/16	.652		1 13/16	11.11	
1/2	.845	1.15	1 7/8	11.88	
9/16	1.08	1.00	1 15/16	12.70	
5/8	1.32	.85	2	13.52	
11/16	1.61	.75	2 1/16	14.39	1.25
3/4	1.90		2 1/8	15.26	
13/16	2.25		2 3/16	16.18	
7/8	2.59	.70	2 1/4	17.11	
15/16	2.96		2 5/16	18.09	
1	3.38		2 3/8	19.07	
1 1/16	3.85		2 7/16	20.09	
1 1/8	4.28		2 1/2	21.12	1.50
1 3/16	4.78		2 5/8	23.59	
1 1/4	5.28		2 3/4	25.56	
1 5/16	5.84		2 15/16	29.18	
			3	30.42	
			3 1/16 to 4	.....	2.00

*See list of extras on page 8 for cutting to other lengths.

We make squares up to 2 inches (inclusive).

An intermediate size takes the price of the next finer size provided for. Example: For 11/64 inch we charge the same price as for 5/32 inch.

Net Extras for Size on Screw Stock



HEXAGONS

***In Lengths 5 Feet to 24 Feet Inclusive**

For Screws, Nuts, Bolts, Etc.

Size, Inches	Pounds per Foot	Per 100 Lbs.
1/8	.045	$5.00
5/32	.071	
3/16	.104	4.00
7/32	.138	
1/4	.195	2.50
5/16	.290	
3/8	.430	1.75
7/16	.560	
1/2	.730	1.15
9/16	.930	1.00
5/8	1.15	.85
11/16	1.40	.75
3/4	1.66	
13/16	1.91	
7/8	2.25	.70
15/16	2.58	
1	2.94	
1 1/16	3.33	
1 1/8	3.73	
1 3/16	4.15	
1 1/4	4.60	
1 5/16	5.07	

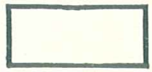
Size, Inches	Pounds per Foot	Per 100 Lbs.
1 3/8	5.57	$0.90
1 7/16	6.07	
1 1/2	6.62	
1 9/16	7.17	
1 5/8	7.76	
1 11/16	8.37	
1 3/4	9.00	
1 13/16	9.67	
1 7/8	10.32	
1 15/16	11.05	
2	11.78	
2 1/16	12.51	1.25
2 1/8	13.31	
2 3/16	14.09	
2 1/4	14.91	
2 5/16	15.80	
2 3/8	16.61	
2 7/16	17.50	
2 1/2	18.40	1.50
2 5/8	20.31	
2 3/4	22.29	
2 15/16	25.38	
3	26.50	
3 1/16 to 4	.....	2.00

*See list of extras on page 8 for cutting to other lengths.

We make hexagons up to 2 inches (inclusive).

An intermediate size takes the price of the next finer size provided for. Example: For $\frac{11}{64}$ inch we charge the same price as for $\frac{5}{32}$ inch.

Net Extras for Size on Screw Stock



FLATS

***In Lengths 5 Feet to 24 Feet Inclusive**

For Finger Bars, Knife Backs, Keys, Engine Guides, Elevator Slides, Etc.

(Prices Given are per 100 Lbs.)

Thickness, Inches	Width, Inches						
	1/4"	5/16" to 1/2"	9/16" to 23/32"	3/4" to 1"	1 1/16" to 1 1/2"	1 9/16" to 3"	Wider than 3"
1/8" and 5/32"	$8.50	$6.50	$5.50	$4.50	$3.50	$3.00	$3.50
3/16" to 5/16"	7.75	5.75	5.25	3.75	2.75	1.75	3.00
3/8" to 7/16"	.....	4.75	4.25	2.75	2.75	1.75	2.50
1/2" to 9/16"	.....	.....	3.25	1.75	1.75	1.50	2.50
5/8" to 11/16"	.....	.....	2.75	1.50	1.50	1.50	2.50
3/4" to 15/16"	....	....	.....	1.50	1.50	1.50	2.50
1" to 1 7/16"	.....	.....	.....	.....	1.50	1.50	2.50
1 1/2" to 1 11/16"	.....	.....	.....	.....	.....	1.50	2.50
1 3/4" to 1 15/16"	.....	.....	.....	.....	.....	1.50	2.50
2" to 2 15/16"	.....	....	.....	.....	.....	1.50	2.50

*See list of extras on page 8 for cutting to other lengths.

Card of Extras Applying on Screw Stock

(Cold Finished Steel)

Adopted March 10, 1924

QUANTITY DIFFERENTIALS.

All specifications for less than 2000 pounds of a size will be subject to the following extras, the total weight of a size ordered to determine the extra, regardless of length and regardless of the exact quantity actually shipped:

1000 to 1999 pounds	$0.20 per 100 pounds net
Less than 1000 pounds	.50 " 100 " "

EXTRA FOR ODD AND INTERMEDIATE SIZES.

The following sizes in rounds, hexagons and squares shall be considered standard:

By 64ths to 1", inclusive.
By 32nds, 1 1/32" to 1 31/32", inclusive.
By 16ths, 2" to maker's limit.

All "Odd and Intermediate Sizes" or any specifications not strictly within the limits of the "Standard Manufacturing Tolerances" shown herein, are subject to a net extra of $0.25 per 100 pounds, in addition to the usual extra for size, accuracy, etc. However, the extra for "Odd and Intermediate Sizes" shall not apply on 20,000 pounds or more of a size.

BOXING AND BURLAPPING.

Boxing (minimum 75c), domestic shipment	$0.50 per 100 pounds net
Boxing (minimum $1.00, export shipment	.75 " 100 " "
Burlapping, full length (minimum 25c)	.25 " 100 " "
Burlapping as required by railroads (minimum 25c)	.15 " 100 " "

The railroads require all shippers to burlap (both ends and middle) all less than carload shipments weighing less than 24,000 pounds.

EXTRAS FOR LONG AND SHORT LENGTHS.

	Per 100 Pounds Net			
	Rounds	Squares	Hexagons	Flats
3" to 5 15/16"	$1.50	$1.50	$1.50	$3.00
6" to 11 15/16"	.75	.75	.75	1.50
12" to 23 15/16"	.45	.60	.45	.75
24" to 59 15/16"	.30	.30	.30	.40
60" to 119 15/16"	.20	.20	.20	.30

Lengths longer than 24 ft. and less than 30 ft.	$0.50 per 100 pounds net
30 ft. and less than 35 ft.	1.00 " 100 " "
35 ft. and less than 40 ft.	1.50 " 100 " "
40 ft. and less than 45 ft.	2.00 " 100 " "
45 ft. and longer	2.50 " 100 " "

Extras for long lengths apply to Rounds, Squares, Hexagons and Flats.

EXTRAS FOR SPECIAL AND HIGH CARBON STEELS.

"Screw Stock"—Bessemer or Open Hearth	$0.10 per 100 pounds net
Specified Analysis (Open Hearth)—Carbon .30% and less	.25 " 100 " "
Specified Analysis (Open Hearth and Bessemer)—Carbon .31% to .50%	.50 " 100 " "

EXTRAS FOR CHAMFERING (For Automatic Screw Machine Use Only).

	Rounds Per 100 Pounds Net	Hexagons and Squares Per 100 Pounds Net
7/16" to 5/8"	$0.13	$0.15
11/16" to 15/16"	.10	.13
1" to 2"	.065	.115
2 1/16" and larger	.04	.10

These extras apply on lengths 10 ft. and longer and one end of bar only.

STANDARD MANUFACTURING TOLERANCES.

Cold Finished Steel Bars (Bessemer and Open Hearth Screw Stock and Special Open Hearth Specifications .50% Carbon and Less).

	Variations and Sizes			
	Rounds and Hexagons		Squares	
Diameter	Under	Over	Under	Over
Up to 0.3", incl.	0.002"	0	0.0025"	0.0025"
Over 0.3 to 1", incl.	0.003"	0	0.0025"	0.0025"
Over 1 to 2½", incl.	0.004"	0	0.004"	0.004"
Over 2½"	0.005"	0	0.005"	0.005"

	Flats Width and Thickness	
Diameter	Under	Over
Up to 0.3", incl.	0.003"	0.003"
Over 0.3 to 1", incl.	0.003"	0.003"
Over 1 to 2½", incl.	0.004"	0.004"
Over 2½"	0.005"	0.005"

Names of Wire for Manufacturing Purposes

A

ACME SPRING WIRE
AIRPLANE WIRE
ALUMINIZED WIRE
AMERICAN FINISH
ANNEALED WIRES
- Annealed Basic Wire
- Annealed Baling Wire
- Annealed Boiler Rods
- Annealed Bessemer Wire
- Annealed Fence Wire
- Black Annealed Wire
- Bright Annealed Wire
- White Annealed Wire

ARMATURE BINDING WIRE
ARMOR WIRE: ARMORING WIRE
ATLAS SPOKE WIRE
ATLAS STEEL (or Typewriter Pull Wire)
AUTO TIRE WIRE
AWL STEEL
AXLE WIRE

B

BAIL WIRE (Pail Bail Wire)
BALANCE SHAFT
BALE TIE WIRE
BALING WIRE
- Annealed Baling Wire
- Low Carbon Baling Wire
- High Carbon Baling Wire
- Medium Carbon Baling Wire

BALL STEEL
BALL PIN WIRE
BANANA KNIFE STEEL
BARBED NAIL WIRE
B. C.
BED RODS
BELL HEAD RIVET WIRE
BELL WIRE (Gong Bell Wire)
BELT HOOK WIRE
BELT LACING WIRE
BICYCLE CHAIN STUD STOCK
BILLIARD CUSHION WIRE
BICYCLE SPOKE WIRE
BINDING WIRE
BIRD CAGE WIRE
- Tinned Bird Cage Wire

BIRD CAGE SPRING WIRE
BLACK WIRE
BLANKET PIN WIRE
BLUED BEST BESSEMER
BLUE FISH WIRE
BOBBIN WIRE
BOBBIN HOLDER WIRE
BOBBIN RING WIRE
BOILER RODS
BOLT AND RIVET WIRE
BOND WIRE
BONNET WIRE
BOOKBINDER WIRE
BORDER RODS
BOTTLE HANDLE WIRE
BOTTLING WIRE
BOX BINDING WIRE
BOX HINGE WIRE
B. P. RIVET WIRE
BRACE RODS
BRACKET WIRE
BRICK CUTTING WIRE
BRIDGE WIRE
- Optical Bridge Wire

BRIDGE RIVET WIRE
BRIGHT BASIC WIRE
BRIGHT BESSEMER WIRE
BRIGHT SOFT BASIC WIRE
BRIGHT SOFT BESSEMER WIRE
BRONZE FINISH WIRE
BROOM WIRE
BRUSH HANDLE WIRE
BRUSH WIRE
- Scratch Brush Wire
- M. B. K.
- Improved TP
- Improved "S"

BUCKLE WIRE
BUCKLE TONGUE WIRE
BUNDLING WIRE
BURR WIRE
BUTT WIRE
BUTTON EYE WIRE
BUTTON BACK WIRE
BUTTON FASTENER WIRE
BUTTON HOOK WIRE

C

C WIRE
C SPRING WIRE
CABLE ARMOR WIRE
CAGE WIRE
- Bird Cage Wire

CALF WEANER WIRE
CALK PIN WIRE
- Ex. H. B. Calk Pin Wire

CALK WIRE
CAP SCREW WIRE
CAR HEATER WIRE
CAR SEAL WIRE
CARD WIRE
CAR STAKE WIRE
CAR SEAT WIRE
CARD RACK WIRE
CARPET BEATER WIRE
CARRIER WIRE
CASE HARDENING WIRE
CAST STEEL WIRE
- Cast Steel Spring Wire

CASTER PIN WIRE
CEILING HOOK WIRE
CHAIN BAR
CHAIN WELDING WIRE
CHAIN WIRE
CHAIR RODS
CHAIR WIRE
CHANDELIER CHAIN WIRE
CHANNEL PIN STEEL
CHANNEL PIN WIRE
CHAPLET WIRE
CHARCOAL IRON WIRE
CHECK ROWER WIRE
CHENILLE WIRE
CHIEF WIRE
CLASP WIRE
CLAY CUTTING WIRE

CLIMAX FINISH
CLIP WIRE
CLOCK WIRE
- Filling Wire, Lock Work Wire, Pendulum Wire, Pillar Wire, Pinion Wire, Pinion Needle Wire, Riveting Wire
- Dial Arbor Wire
- Hammer Spring Wire

CLOTHES LINE WIRE
CLOTHES PIN WIRE
COAT AND HAT HOOK WIRE
COILED SPRING STEEL FENCE WIRE
COMB WIRE
COPPERED WIRE
CORE WIRE
CORE WIRE (for Foundry Use)
CORE (MAGNETIC) WIRE (for Electrical Use)
- Silico Magnetic Core Steel

CORK FASTENER WIRE
CORK SCREW WIRE
COTTON TIE WIRE
COTTON TIE BUCKLE WIRE
COUPLER WIRE
CRIMPING WIRE
CROWN "K" SCRATCH BRUSH WIRE
CROWN "L" SPRING WIRE
CROWN MUSIC WIRE
C. S. R. WIRE
CROWN "K" HEDDLE WIRE
CROQUET ARCH WIRE
CURLING IRON WIRE
CURRY COMB WIRE
CURTAIN RODS

D

DAMPER RODS
D. C. WIRE, TINNED
DENTAL BROACH WIRE
DENT WIRE
DIAL ARBOR WIRE
DIPPED TINNED WIRE
DOBBY SPRING WIRE
DOOR SPRING WIRE
DOUBLE ANNEALED WIRE
DOUBLE CLINCH WIRE
DOWEL WIRE
- L. S. Dowel Pin Wire

DRAPERY PIN WIRE
DRESS SHIELD WIRE
DRESS SUIT CASE RIVET WIRE
DUCK BILL NAIL WIRE

E

EXTRA GALVANIZED WIRE
EAVE TROUGH HANGER WIRE
EDGE WIRE
EGG BEATER WIRE
EXTRA H. B.
EXTRA H. B. CALK PIN WIRE
EYE GLASS POST STOCK
EYE GLASS WIRE
EYE GUARD WIRE
EYE WIRE

F

FALLER WIRE
F. C. STEEL
FENCE WIRE
- Galvanized Coiled Spring Steel Fence Wire

FERRULE WIRE
FERRY CROSSING WIRE
FILISTER HEAD SCREW WIRE
FILLING WIRE
FIRING PIN WIRE
FISH HOOK STEEL
FISH HOOK WIRE
FLESH FORK WIRE
FLORISTS' WIRE
FLY KILLER WIRE
FRONT SIGHT STOCK
FRUIT JAR WIRE
FUSE WIRE

G

GARMENT HANGER WIRE
GAS TUBING WIRE
GATE HOOK WIRE
GEM CLIP WIRE
GILL PIN WIRE
GIMLET WIRE
- M. B. Gimlet Wire

GLASS NETTING WIRE
GONG BELL WIRE
GRAPE TIE WIRE
GRASS CATCHER WIRE
GREASE DRAWN WIRE
GUARD WIRE
- Shuttle Guard Wire
- Trouser Guard Wire
- Eye Guard Wire

GUN BARREL WIRE
GUN RIB WIRE
GUN SCREW WIRE
GUN WRAPPING WIRE

H

HAIRPIN WIRE
HAIR SPRING WIRE
HALTER CLAMP WIRE
HAME TONGUE WIRE
HANDLE WIRE
HARNESS SNAP WIRE
HARP WIRE
HARD CENTER TOE CALK STEEL
HAT AND COAT HOOK WIRE
HAT RODS
H. B. STEEL
H. C.
HEATER WIRE
HEDDLE WIRE
- Bronze
- Tinned
- Tinned Twin
- Crown "K"

HIGH CARBON BALING WIRE
HINGE PIN WIRE
HINGE WIRE
HOG RING WIRE
HOOK AND EYE WIRE
HOOP WIRE

HORSE BRUSH WIRE
HORSE CARD WIRE
HORSE NAIL WIRE
HORSE NAIL RODS
HOSE BINDING WIRE
HOSE POLES
HOSE WINDING WIRE
HOSE WIRE
HUSKING PIN WIRE
HUTTER WIRE

I

I-BEAM RAIL BAR WIRE
ICE PICK WIRE
IMPROVED CROWN "K" HEDDLE WIRE
INSERTER WIRE

J

JACK CHAIN WIRE
JAPANNING
J. B. WIRE
JOINT WIRE

K

KEY WIRE
KEY RING WIRE
KEY STOCK
KEYSTONE WIRE
KING WIRE
KITE FLYING WIRE

L

LACING WIRE
LANTERN GUARD CATCH WIRE
LANTERN WIRE
LATHING WIRE
LEAD SCREW STOCK
LIGHTNING ROD BRACES
LIME BRIGHT WIRE
LIME FINISH WIRE
LINK WIRE
LINK WIRE FINISH
LINGO WIRE
LIQUOR FINISH WIRE
LOCK SPRING WIRE
LOCK WORK WIRE
LOW CARBON BALING WIRE
LOCK WASHER WIRE

M

MACHINERY WIRE
MACHINERY SPRING WIRE
MACHINE SCREW STOCK
MAGNETIC CORE WIRE
MANDOLIN WIRE
MANTLE SUPPORT WIRE
MANTLE RING WIRE
MARKET WIRE
MASHER WIRE
MAT BORDER RODS
MAT WIRE
M. B. STEEL
MEAT TAG FASTENER WIRE
MORRIS CHAIR RODS
MUSIC WIRE
MUZZLE WIRE

N

NAIL HEAD WIRE
NAIL SET WIRE
NAIL WIRE
NECKTIE RETAINER WIRE
NECK WIRE
NECK YOKE RING WIRE
NEEDLE WIRE
- Sewing Machine Needle Wire
- Latch or Spring Needle Wire
- Knitting Needle Wire
- M. B. or Jacquard Needle Wire
- Crochet Needle Wire
- Phonograph Needle Wire

NEEDLE BAR STEEL
NETTING WIRE
NICKEL STEEL
NIPPLE WIRE
NONPAREIL WIRE
NOSE WIRE
N. R. STAPLE WIRE
NUT CRACK STEEL
NUT LOCK WIRE

O

ODD SHAPED WIRE
OIL RING WIRE
OIL STRAINER WIRE
OPTICAL SCREW WIRE
OPTICAL WIRE
- Eye Wire
- Eye Glass Wire
- Eye Guard Wire
- Bridge Wire
- Nose Wire
- Temple Wire
- Dowel Wire
- L. S. Dowel Pin Wire
- Optical Screw Wire
- Post Stock
- Riding Bow Wire

ORGAN WIRE
OVEN RACK WIRE

P

PACKAGE HANDLE WIRE
PAIL BAIL WIRE
PAIL RIM WIRE
PARASOL RODS
PATENTED WIRE
PAWL WIRE
- Ratchet Pawl Wire

PEDAL RODS
PENDULUM WIRE
PEN HOLDER RACK WIRE
PHONOGRAPH NEEDLE WIRE
PIANO BOLT WIRE
PIANO RODS
PIANO TUNING PIN WIRE
PICKER TOOTH WIRE
PICKER WIRE
PICTURE CORD WIRE

PILE WIRE
- Two-thirds Round

PILLAR WIRE
PINION WIRE
PINION NEEDLE WIRE
PINION STEEL
PIN WIRE
- Bridge Pin Wire
- Caster Pin Wire
- Hat Pin Wire
- Hinge Pin Wire
- Safety Pin Wire
- Firing Pin Wire
- Toilet Pin Wire

PIPE CLEANER WIRE
PIVOT WIRE
PIPE WINDING WIRE
PLANT STAKES
PLOW ARM WIRE
PLOW STEEL SPRING WIRE
PLUNGER WIRE
PORCH SWING CHAIN WIRE
POST STOCK
POT CHAIN WIRE
POULTRY NETTING WIRE
- Bright
- Liquor Finish
- Annealed, Black Annealed
- Bright Annealed, Blue Annealed, White Annealed

P. S. R. WIRE
PUMP CHAIN WIRE

R

RAKE TOOTH WIRE
RAMROD WIRE
RATCHET PAWL WIRE
RAT TRAP WIRE
RAT TRAP SPRING WIRE
REED WIRE
REFRIGERATOR SHELF WIRE
REINFORCEMENT WIRE
RESISTANCE WIRE
- Tico Resistance Wire

RETAINER WIRE
RIDING BOW WIRE
RING OILER WIRE
RING TRAVELER WIRE
RIVETING WIRE
RIVET RODS
RIVET WIRE
- A. A. Rivet Wire
- Bifurcated Rivet Wire
- B. P. Rivet Wire
- Tubular Rivet Wire
- Bell Head Rivet Wire, Dress Suit Case Rivet Wire
- Umbrella Head Rivet Wire, Mushroom Head Rivet Wire

ROCK SHAFT STOCK
ROLL PROTECTOR WIRE
ROPE WIRE
ROSE STAKES

S

SADDLE SPRING WIRE
SAFETY PIN WIRE
SAFETY SET SCREWS
SATIN FINISHING WIRE
SCALE BAR STOCK
SCRATCH BRUSH WIRE
SCREEN WIRE
SCREW EYE WIRE, SCREW HOOK WIRE
SCREW STOCK
SCREW WIRE
SCREW DRIVER WIRE
SEPARATOR WIRE
SEWING MACHINE NEEDLE WIRE
SEWING WIRE
SHADE ROLLER WIRE
SHADE SPRING WIRE
SHELF WIRE
SHOE LACE WIRE
SHUTTLE GUARD WIRE
SHUTTLE STEEL
SIGHT STOCK
SILICO MAGNETIC CORE STEEL
SILO WIRE
SKEWER WIRE
SNARE WIRE
SOUND WIRE
SPINDLE STEEL
SPINDLE STEEL M. B.
SPINNING WIRE
SPIRAL HOOPING
SPIRAL SPRING STEEL FENCE WIRE
SPLINE STEEL
SPOKE WIRE
SPOKE BLANKS
SPRING WIRE
STAPLE WIRE, STAPLING WIRE
STEEL WOOL WIRE
STITCHING WIRE
STILETTO WIRE
STONE WIRE
STOVE BOLT WIRE
STOVE PIPE WIRE
STOVE POKERS
STOVE POKER HANDLES
STOVE RODS
STUD STOCK
SUCKER RODS
SURFACE GAUGE SPINDLE STEEL
SURVEYORS' CHAIN WIRE
SWEDES IRON WIRE

T

TACK WIRE
TAG FASTENER WIRE
TAG WIRE
T. C. WIRE
TAPER PINS
TEMPERED WIRE
TEMPLE WIRE
TEMPLE TOOTH WIRE
TICO RESISTANCE WIRE
T. P. WIRE
TOE CALK WIRE
TOILET PIN WIRE
TORSION WIRE
TOWEL RODS
T. R. WIRE
TRACE CHAIN WIRE
TRAP SPRING WIRE
TRANSOM RODS
TRAVELER WIRE
TRELLIS WIRE
TUBE STEEL

TUBING WIRE
TUNING PIN WIRE
TYPE BAR WIRE
TYPE STOCK

U

UMBRELLA HEAD RIVET WIRE
UNDER RIB WIRE

W

WARP WIRE
WASH BOILER WIRE
WELDING WIRE
Oxy-Acetylene Welding Wire
WHIP GUARD WIRE
WHITE ANNEALED WIRE
WHITE LIQUOR FINISH WIRE
WICK STEMS
WIPING ROD WIRE
WOOD SCREW WIRE
WOOL WIRE
WRAPPING WIRE
W. TEMPER
W. W. SCREW WIRE

X

X. S. A. C.

Premier Spring Steel Wire

Premier Spring Steel Wire can be supplied in black, coppered, lacquer finished, tinned or galvanized. At one time, what is known as "Premier" bore different names, such as:

High Grade Steel Spring Wire,
Furniture Spring Wire,
Best Steel Spring Wire,
Steel Spring Wire, Knotting Quality.

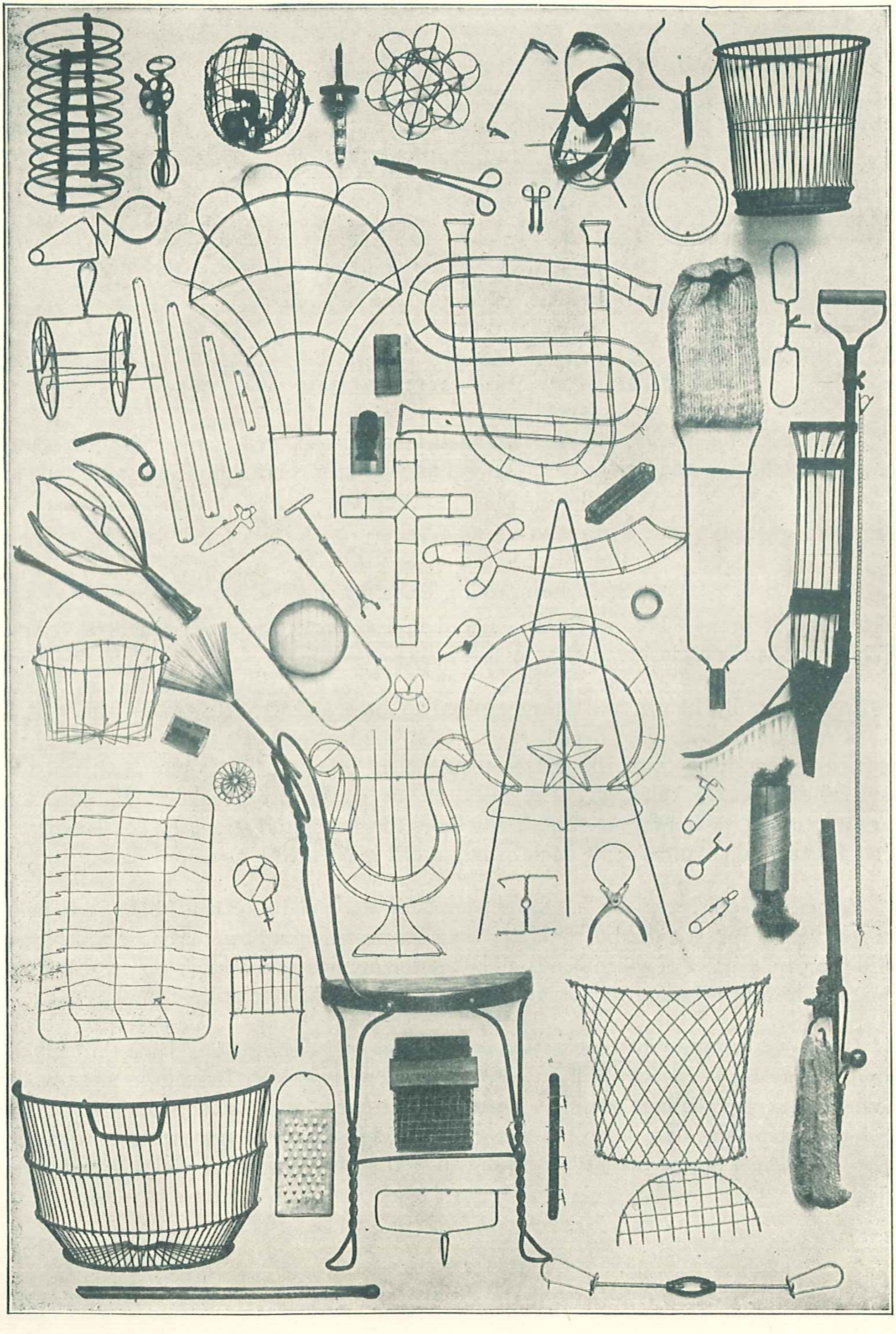
The name or brand "Premier" was adopted in 1902, and the American Steel & Wire Company has the exclusive right to use it.

It is generally known and acknowledged to be a strictly high grade wire. It is made of high carbon, open hearth steel. The point of carbon varies according to the particular requirements of the different customers using it. It is patented, which is another term for air tempered. The object of this heat treatment is to obtain a particular structure of such a nature that it combines toughness and strength. It is expected that Premier will stand a right angle bend, and it is rejected if signs of fracture appear.

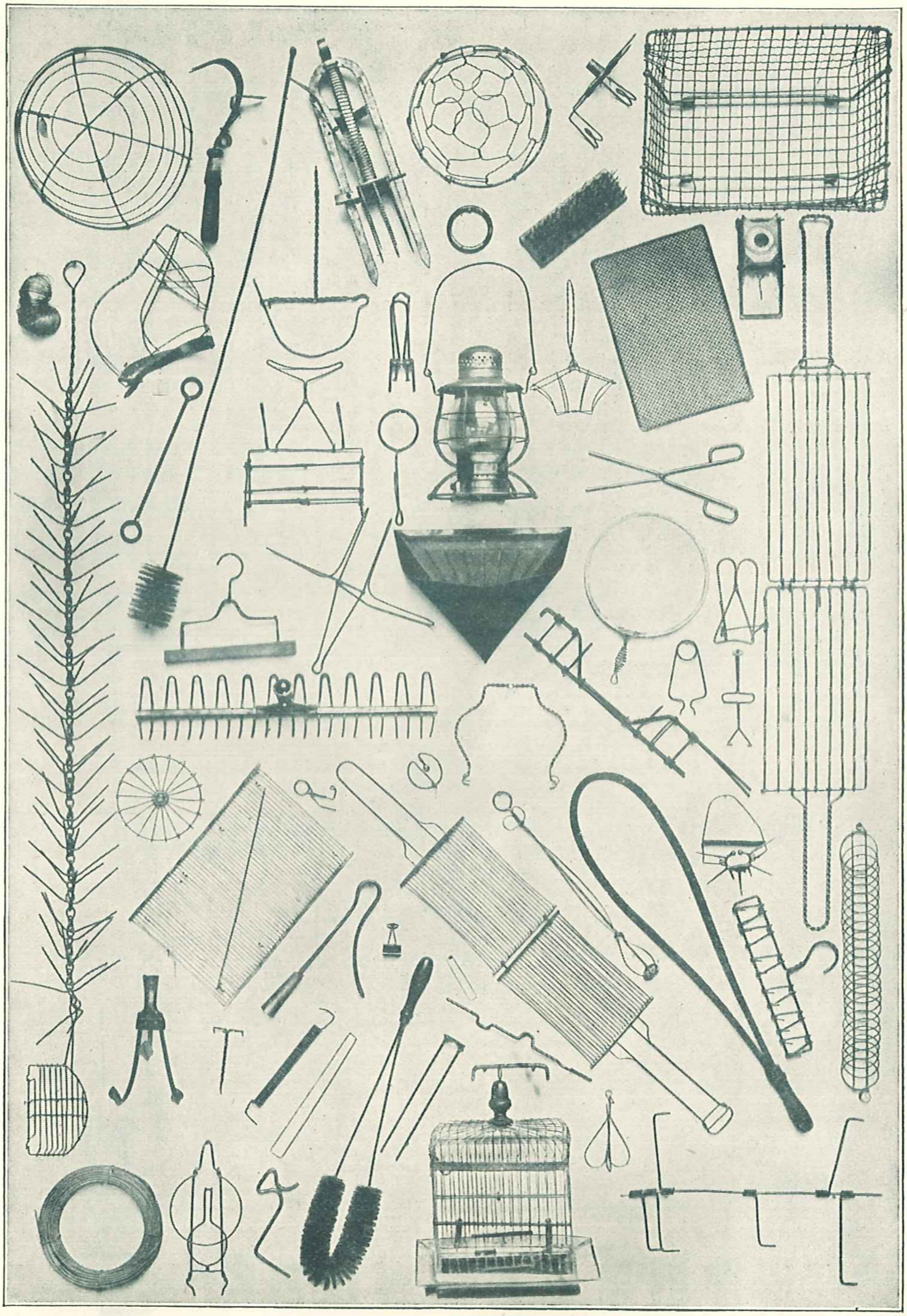
Some sizes are tested by hand, both ends of the coil being bent, both ends being gauged also. But standard or ordinary sizes are tested in a power crimper which puts into the wire a series of sharp bends, it being the opinion that wire so tested will stand the tests to which it is put in actual operation, that is, the test of knotting.

Great care is taken in the selection of the steel and when putting same through the sundry processes in the wire mill and elsewhere. Long experience has shown what should be done to secure the best results. The facts that our sales are steadily on the increase and that complaints are almost unknown, speak for themselves, showing conclusively that the Premier Spring Steel Wire is fully answering the purpose for which it is desired.

Some Varieties of Articles made from Round Wire



Some Varieties of Articles made from Round Wire



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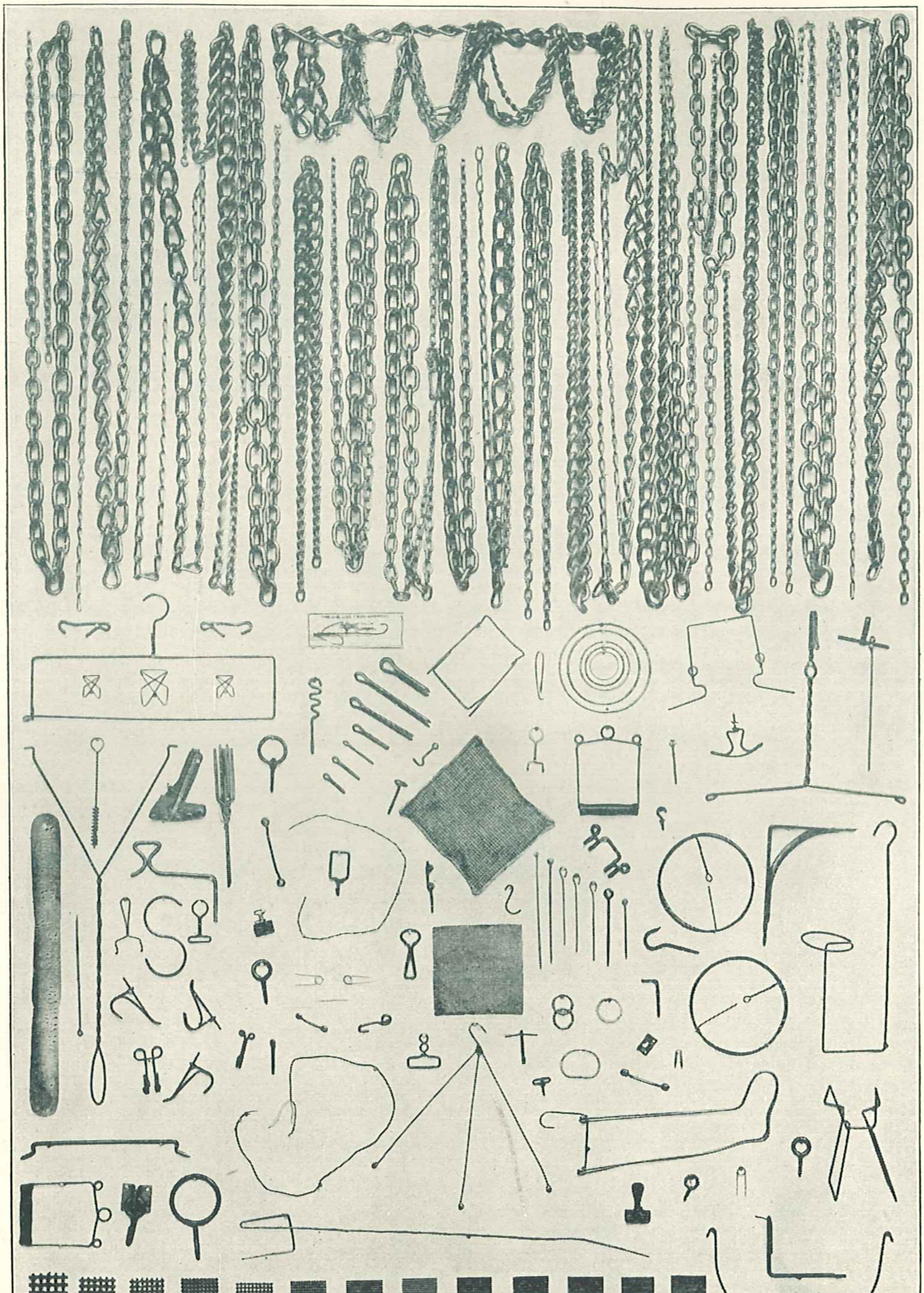

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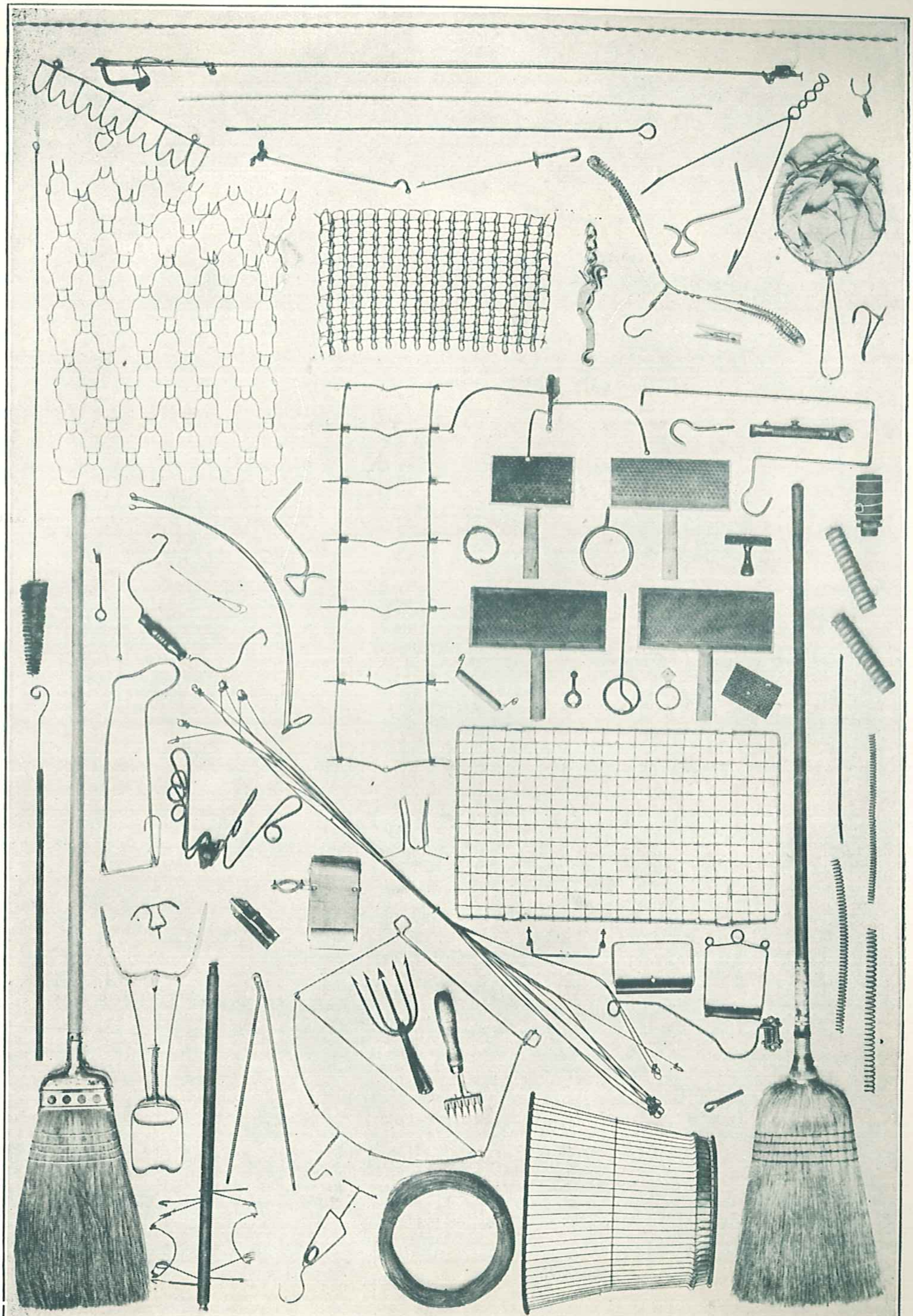

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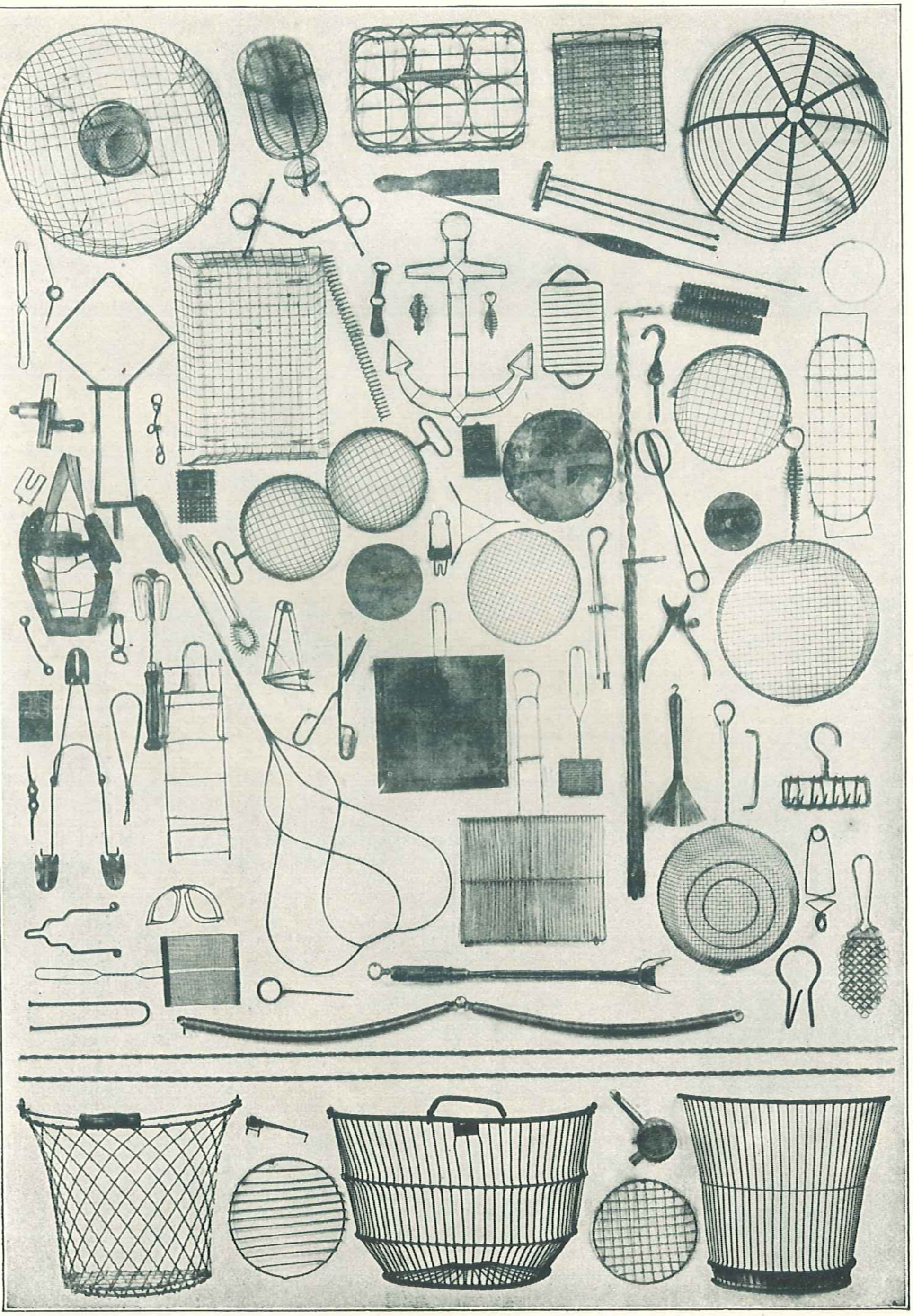


American Piano Wire

Complies with all Mechanical and Acoustic Requirements. The modern piano wire of absolute uniformity; tensile strength without extreme hardness; tough, fibrous wire that when actuated by the proper amount of energy vibrates evenly throughout.

American Steel & Wire Company's
Piano Wire

Gauge, Diameter, and Weight in Grains Per Inch

American Steel & Wire Company's Piano Wire Gauge	Diameter	Weight in Grains per Inch	Logarithm
13	.031	1.48289	0.1711090
13½	.032	1.58691	0.2005496
14	.033	1.69211	0.2284286
14½	.034	1.78602	0.2518863
15	.035	1.87504	0.2730105
15½	.036	2.00459	0.3020255
16	.037	2.11375	0.3250433
16½	.038	2.23363	0.3490054
17	.039	2.34837	0.3707665
17½	.040	2.47681	0.3938926
18	.041	2.59231	0.4136870
19	.043	2.85600	0.4557582
20	.045	3.13166	0.4957746
21	.047	3.46311	0.5395277

Number of Vibrations Per Second at International Pitch. A-435

No.	Key	Pitch	Logarithm	Square	No.	Key	Pitch	Logarithm	Square
1	A	27.187	1.43436930	2.8687386	31	D#	153.795	2.18694430	4.3738886
2	A#	28.804	1.45945513	2.9189103	32	E	162.941	2.21203013	4.4240603
3	B	30.517	1.48454096	2.9690819	33	F	172.629	2.23711596	4.4742319
4	C	32.331	1.50962680	3.0192536	34	F#	182.895	2.26220180	4.5244036
5	C#	34.254	1.53471263	3.0694253	35	G	193.770	2.28728763	4.5745753
6	D	36.291	1.55979846	3.1195969	36	G#	205.292	2.31237346	4.6247469
7	D#	38.449	1.58488430	3.1697686	37	A	217.500	2.33745930	4.6749186
8	E	40.735	1.60997013	3.2199403	38	A#	230.433	2.36254513	4.7250903
9	F	43.157	1.63505596	3.2701119	39	B	244.135	2.38763096	4.7752619
10	F#	45.723	1.66014180	3.3202836	40	C	258.652	2.41271680	4.8254336
11	G	48.442	1.68522763	3.3704553	41	C#	274.032	2.43780263	4.8756053
12	G#	51.323	1.71031346	3.4206269	42	D	290.327	2.46288846	4.9257769
13	A	54.375	1.73539930	3.4707986	43	D#	307.591	2.48797430	4.9759486
14	A#	57.608	1.76048513	3.5209703	44	E	325.882	2.51306013	5.0261203
15	B	61.034	1.78557096	3.5711419	45	F	345.260	2.53814596	5.0762919
16	C	64.663	1.81065680	3.6213136	46	F#	365.790	2.56323180	5.1264636
17	C#	68.508	1.83574263	3.6714853	47	G	387.541	2.58831763	5.1766353
18	D	72.582	1.86082846	3.7216569	48	G#	410.585	2.61340346	5.2268069
19	D#	76.898	1.88591430	3.7718286	49	A	435.000	2.63848930	5.2769786
20	E	81.470	1.91100013	3.8220003	50	A#	460.866	2.66357513	5.3271503
21	F	86.315	1.93608596	3.8721719	51	B	488.271	2.68866096	5.3773219
22	F#	91.447	1.96117180	3.9223436	52	C	517.305	2.71374680	5.4274936
23	G	96.885	1.98625763	3.9725153	53	C#	548.065	2.73883263	5.4776653
24	G#	102.646	2.01134346	4.0226869	54	D	580.655	2.76391846	5.5278369
25	A	108.750	2.03642930	4.0728586	55	D#	615.183	2.78900430	5.5780086
26	A#	115.216	2.06151513	4.1230303	56	E	651.764	2.81409013	5.6281803
27	B	122.067	2.08660096	4.1632019	57	F	690.520	2.83917596	5.6783519
28	C	129.326	2.11168680	4.2233736	58	F#	731.580	2.86426180	5.7285236
29	C#	137.016	2.13677263	4.2735453	59	G	775.082	2.88934763	5.7786953
30	D	145.164	2.16185846	4.3237169	60	G#	821.170	2.91443346	5.8288669

Number of Vibrations Per Second at International Pitch. A-435
—Continued

No.	Key	Pitch	Logarithm	Square	No.	Key	Pitch	Logarithm	Square
61	A	870.000	2.93951930	5.8790386	76	C	2069.220	3.31580680	6.6316136
62	A♯	921.733	2.96460513	5.9292103	77	C♯	2192.262	3.34089263	6.6817853
63	B	976.542	2.98969096	5.9793819	78	D	2322.620	3.36597846	6.7319569
64	C	1034.610	3.01477680	6.0295536	79	D♯	2460.732	3.39106430	6.7821286
65	C♯	1096.131	3.03986263	6.0797253	80	E	2607.054	3.41615013	6.8323003
66	D	1161.310	3.06494846	6.1298969	81	F	2762.078	3.44123596	6.8824719
67	D♯	1230.366	3.09003430	6.1800686	82	F♯	2926.320	3.46632180	6.9326436
68	E	1303.527	3.11512013	6.2302403	83	G	3100.328	3.49140763	6.9828153
69	F	1381.039	3.14020596	6.2804119	84	G♯	3284.682	3.51649346	7.0329869
70	F♯	1463.160	3.16529180	6.3305836	85	A	3480.000	3.54157930	7.0831586
71	G	1550.164	3.19037763	6.3807553	86	A♯	3686.931	3.56666513	7.1333303
72	G♯	1642.341	3.21546346	6.4309269	87	B	3906.168	3.59175096	7.1835019
73	A	1740.000	3.24054930	6.4810986	88	C	4138.440	3.61683680	7.2336736
74	A♯	1843.466	3.26563513	6.5312703					
75	B	1953.084	3.29072096	6.5814419					

Piano Covering Wire

American Steel & Wire Company's Steel Wire Gauge	Diameter	WEIGHT IN GRAINS PER INCH COPPER		WEIGHT IN GRAINS PER INCH STEEL	
		Grains	Logarithm	Grains	Logarithm
34	.0104	.190112	.2790095	.17732	.2487576
33	.0118	.245922	.3907974	.213621	.3296439
32	.0128	.2905088	.4631593	.254270	.4052951
31	.0132	.30654454	.4864936	.269833	.4310950
30	.0140	.358638	.5546563	.304462	.4835331
29	.0150	.40303	.6053374	.354121	.5491517
28	.0162	.4701555	.6722415	.429368	.6328297
27	.0173	.527087	.7218823	.470479	.6725403
26	.0181	.591401	.7718820	.524456	.7197091
25	.0204	.737147	.8675541	.643926	.8088360
24	.0230	.929857	.9684162	.833056	.9206737
23	.0258	1.163955	.0659362	1.05899	.0248919
22	.0286	1.444650	.1597626	1.267394	.1029116
21	.0317	1.761665	.2459233	1.544955	.1889158
20	.0348	2.113073	.3249145	1.883836	.2750430
19	.0410	2.96469	.4719793	2.625467	.4192066
18	.0475	3.96707	.5984698	3.4719256	.5405704

Core Wire No.	American Steel & Wire Company's Steel Wire Gauge	WEIGHT, WOUND STRINGS, PER INCH				WEIGHT, ONE AND ONE HALF INCHES OF COVERING WIRE, WOUND	
		Copper Covered		Steel Covered			
		Weight in Grains	Log.	Weight in Grains	Log.	Copper	Steel
16	34	4.842374	0.6850583	4.658866	0.6682803	4.092936	3.8176740
	33	5.31831	0.7257736	4.8974	0.6899656	4.80684	4.195478
	32	5.676425	0.7540749	5.232008	0.7186684	5.3440125	4.677387
	31	5.78902	0.7626050	5.348275	0.7282137	5.513905	4.8517875
	30	6.23372	0.7947473	5.61136	0.7490681	6.179955	5.446415
17	34	5.191683	0.7152998	5.05590	0.7037985	4.264964	3.978045
	33	5.670373	0.7536116	5.249969	0.7201560	4.990220	4.3523985
	32	6.053187	0.7819841	5.59104	0.7474926	5.5572255	4.864005
	31	6.16906	0.7902190	5.71149	0.7567495	5.731135	5.04468
	30	6.628755	0.8214320	5.98216	0.7768580	6.4205775	5.450685
	29	6.924315	0.8403768	6.36901	0.8040719	6.8639175	6.03960
	28	7.40314	0.8694160	6.96463	0.8428980	7.582155	6.95439

Piano Covering Wire—Continued

Core Wire No.	American Steel & Wire Company's Steel Wire Gauge	WEIGHT, WOUND STRINGS, PER INCH				WEIGHT, ONE AND ONE HALF INCHES OF COVERING WIRE, WOUND	
		Copper Covered		Steel Covered			
		Weight in Grains	Log.	Weight in Grains	Log.	Copper	Steel
18	34	5.55024	0.7443117	5.35121	0.7284520	4.436895	4.138353
	33	6.05884	0.7823895	5.60352	0.7484610	5.199795	4.516815
	32	6.43933	0.8088409	5.95944	0.7752054	5.77053	5.050685
	31	6.55846	0.8168019	6.08348	0.7841521	5.949225	5.236755
	30	7.03313	0.8471486	6.36229	0.8036134	6.66123	5.65497
	29	7.33644	0.8654854	6.76072	0.8299930	7.116195	6.252615
	28	7.82868	0.8936886	7.37440	0.8677267	7.854555	7.173135
19	31	6.96766	0.8430880	6.47525	0.8112566	6.16749	5.428825
	30	7.45726	0.8725793	6.76219	0.8300874	6.901890	5.859285
	29	7.76833	0.8903277	7.17220	0.8556524	7.368495	6.4743
	28	8.27400	0.9177155	7.80397	0.8923156	8.127	7.421955
	27	8.65091	0.9370618	8.02855	0.9046371	8.492365	7.758825
	26	9.15564	0.9616887	8.44254	0.9264731	9.44946	8.37951
	25	10.09084	1.0039273	9.17591	0.9626492	10.852260	9.479865
	24	11.29008	1.0526970	10.41206	1.0175367	12.65112	11.33409
20	28	8.916213	0.9501803	8.43432	0.9260542	8.3994195	7.6707480
	27	9.119327	0.9599625	8.470082	0.9278834	8.9713005	8.0076345
	26	9.63560	0.9838788	8.89934	0.9493578	9.75591	8.65142
	25	10.59239	1.0249940	9.64889	0.9844773	11.191095	9.775845
	24	11.81824	1.0725538	10.91393	1.0379811	13.02987	11.673405
	23	13.23414	1.1216957	12.32310	1.0907199	15.15372	13.78716
	22	14.90016	1.1737004	13.456	1.1289218	17.65275	15.48678
21	26	10.350846	1.0149758	9.569754	0.9809105	10.331604	9.159966
	25	11.96177	1.0777795	10.88701	1.0369086	12.74799	11.13585
	24	12.353816	1.0918090	11.428264	1.0579790	13.336059	11.9482731
	23	13.84661	1.1413463	12.91023	1.1109340	15.57535	14.17068
	22	15.54663	1.1916363	14.06401	1.1481092	18.12528	15.90135
	21	17.31462	1.2383949	15.61068	1.1934218	20.777365	18.221355
	20	19.20961	1.2835186	17.50134	1.2430713	23.61975	21.327345

The difference in tone quality between the plain wire and wound strings so noticeable at the break, is greatly augmented by a greater tension on the bass strings, and as the tension is directly as the square of the pitch; directly as the square of the length, and directly as the weight, the accompanying formulæ are submitted in the hope that their utilization shall make possible the mathematical calculation of pitch, length, and weight to the great relief of string makers, tone regulators and finishing tuners and to the financial benefit of the companies employing them.

Experimental research has demonstrated that the general practice of string makers in the United States is correct. This being the case, lengths, weights and tensions need be computed only on the first few strings from the break, the established practice of string makers being relied upon consistently to adjust the balance of the scale.

The very natural query, "What is the correct tension for bass strings?" may as naturally be answered by another question, "What tone quality is desired?" One principle, however, may be given full consideration: *There is a point in tension beyond which no piano wire may be drawn without impairing its present or prospective efficiency.*

Numerous experiments have given ample data for the deduction that this point of maximum tension lies very close to 175 pounds. The breaking weight of the wire then becomes a factor only as indicating its elastic limit.

The above deductions are made upon the assumption that International pitch (A-435) shall be used, and makes due allowance for the overdrawing of chipper and first tuner.

American Equal Tension Scale

To Find the Length, Weight, or Tension of a Wound String of American Steel & Wire Company's Piano Wire Having One and One Half Inches of Uncovered Core Wire

If a piano bass string were wound to or beyond bridge pin and agraffe, or in other words, if the string were wound its entire vibrating length, weight, tension, length or pitch easily might be computed by the rule governing plain piano wire. The practice, however, of leaving about 1½″ of this vibrating length uncovered necessitates a formula having for its basis an approximation.

This approximation, however, is no greater than the practical application of an accurate result, owing to the empirical range of gauges.

Let L equal the length in inches, T equal the tension in pounds avoirdupois, P equal the number of vibrations per second of time, and C equal the weight of covering wire on one and one-half inches of core wire.

TO FIND THE TENSION

Multiply the square of the pitch by the square of the length, multiply this product by the weight in grains per inch of wound string minus $\frac{C}{L}$ and divide the product by 675,356. The quotient is the tension in pounds avoirdupois.

$$T = \frac{P^2 L^2 \left(W - \frac{C}{L}\right)}{675{,}356}$$

TO FIND THE LENGTH

Multiply the square root of the tension by 821.8 and divide by the pitch times the square root of the weight in grains per inch of the string next lighter in weight to the one to be used in the stringing. The quotient is the length in inches.

$$L = \frac{821.8 \sqrt{T}}{P \sqrt{W}}$$

TO FIND THE WEIGHT

Multiply the tension by 675,356 and divide the product by the square of the pitch times the square of the length in inches. The quotient is the weight in grains per inch. When this is determined consult the tables and use the string next lighter in weight.

$$W = \frac{675{,}356\ T}{P^2 L^2}$$

To Find the Pitch, Weight, Length, or Tension of American Steel & Wire Company's Piano Wire

The pitch is inversely as the square root of the weight; directly as the square root of the tension and inversely as the length.

TO FIND THE TENSION

Multiply the square of the pitch by the square of the length, multiply this product by the weight in grains per inch and divide by 675,356. The quotient is the tension in pounds avoirdupois.

Let P equal the number of vibrations per second, L equal the length in inches, W equal the weight in grains per inch, and T equal the tension in pounds avoirdupois.

$$T = \frac{P^2 L^2 W}{675{,}356}$$

TO FIND THE LENGTH

Multiply the square root of the tension in pounds avoirdupois by 821.8 and divide by the product of the pitch times the square root of the weight in grains per inch. The quotient is the length in inches.

$$L = \frac{821.8 \sqrt{T}}{P \sqrt{W}}$$

TO FIND THE PITCH

Multiply the square root of the tension in pounds avoirdupois by 821.8 and divide the product by the length in inches times the square root of the weight in grains per inch. The quotient is the number of vibrations per second.

$$P = \frac{821\ 8 \sqrt{T}}{L \sqrt{W}}$$

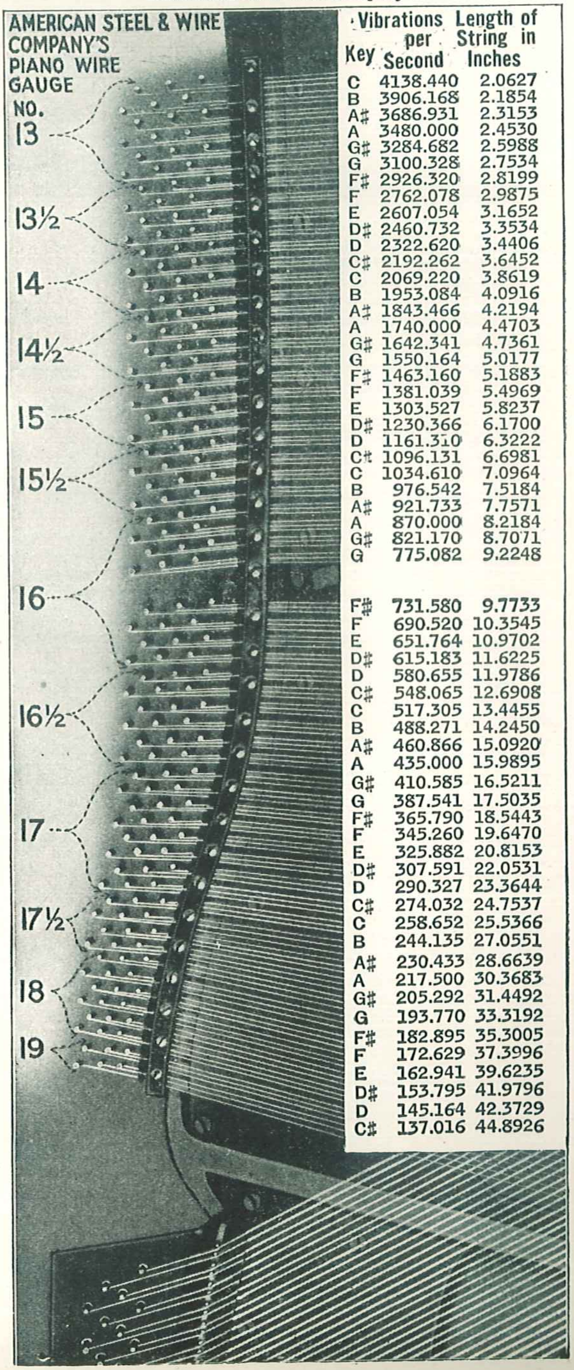
TO FIND THE WEIGHT

Multiplying the tension by 675,356 and divide the product by the square of the pitch times the square of the length. The quotient is the weight in grains per inch.

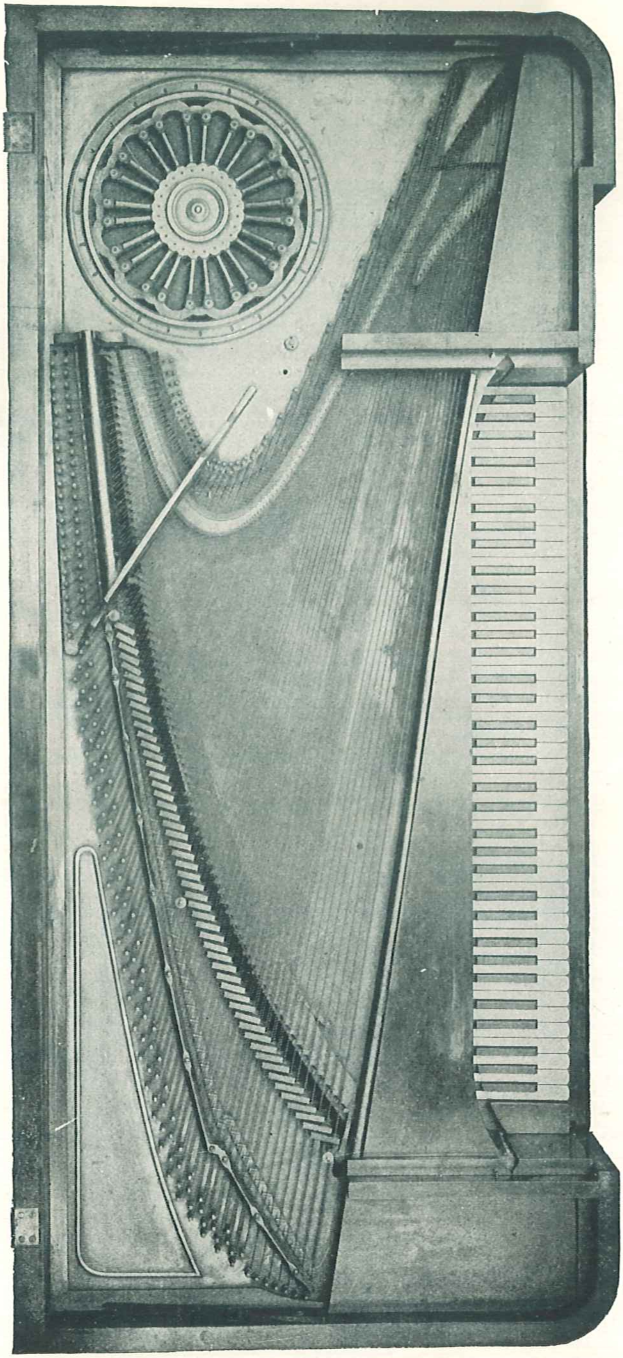
$$W = \frac{675{,}356\ T}{P^2 L^2}$$

To find the total weight in pounds and decimals of a pound, multiply the weight in grains per inch by the length in inches and divide the product by 7,000. If it is desired to express the weight in ounces *multiply as before by the length in inches and divide the product by* 437.5.

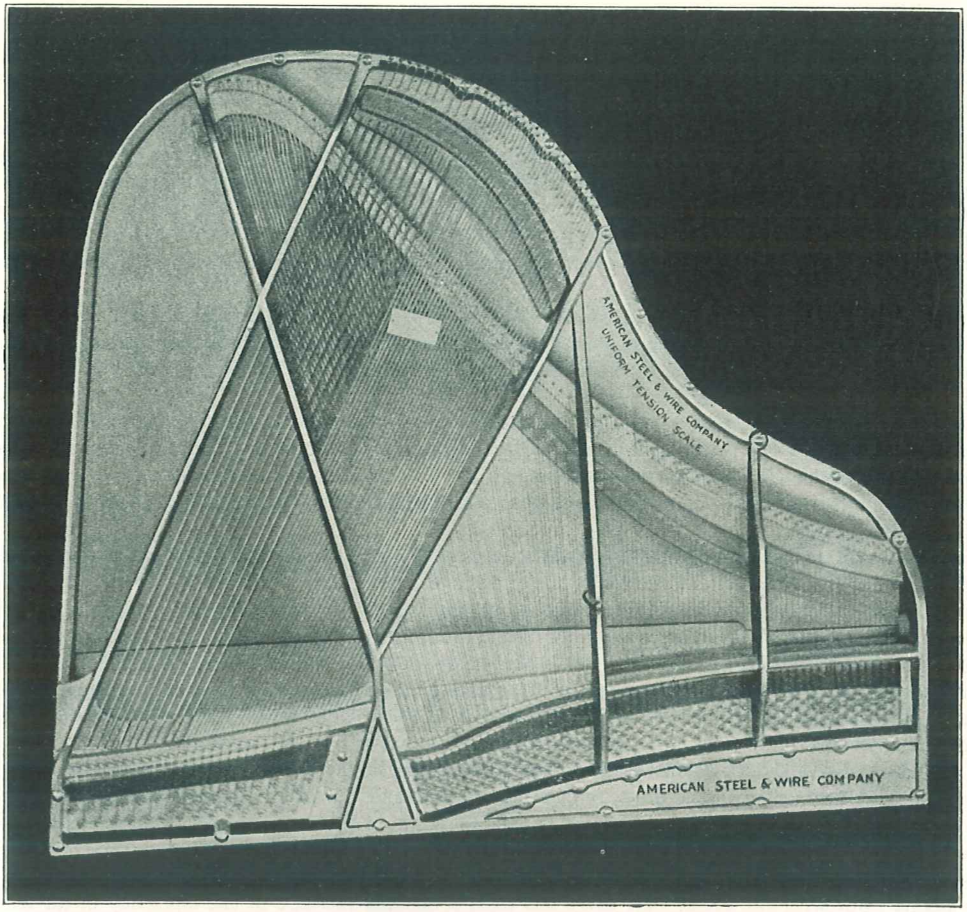
American Steel & Wire Company's



Key	Vibrations per Second	Length of String in Inches
C	4138.440	2.0627
B	3906.168	2.1854
A♯	3686.931	2.3153
A	3480.000	2.4530
G♯	3284.682	2.5988
G	3100.328	2.7534
F♯	2926.320	2.8199
F	2762.078	2.9875
E	2607.054	3.1652
D♯	2460.732	3.3534
D	2322.620	3.4406
C♯	2192.262	3.6452
C	2069.220	3.8619
B	1953.084	4.0916
A♯	1843.466	4.2194
A	1740.000	4.4703
G♯	1642.341	4.7361
G	1550.164	5.0177
F♯	1463.160	5.1883
F	1381.039	5.4969
E	1303.527	5.8237
D♯	1230.366	6.1700
D	1161.310	6.3222
C♯	1096.131	6.6981
C	1034.610	7.0964
B	976.542	7.5184
A♯	921.733	7.7571
A	870.000	8.2184
G♯	821.170	8.7071
G	775.082	9.2248
F♯	731.580	9.7733
F	690.520	10.3545
E	651.764	10.9702
D♯	615.183	11.6225
D	580.655	11.9786
C♯	548.065	12.6908
C	517.305	13.4455
B	488.271	14.2450
A♯	460.866	15.0920
A	435.000	15.9895
G♯	410.585	16.5211
G	387.541	17.5035
F♯	365.790	18.5443
F	345.260	19.6470
E	325.882	20.8153
D♯	307.591	22.0531
D	290.327	23.3644
C♯	274.032	24.7537
C	258.652	25.5366
B	244.135	27.0551
A♯	230.433	28.6639
A	217.500	30.3683
G♯	205.292	31.4492
G	193.770	33.3192
F♯	182.895	35.3005
F	172.629	37.3996
E	162.941	39.6235
D♯	153.795	41.9796
D	145.164	42.3729
C♯	137.016	44.8926



Chickering straight scale square piano No. 18,982, strung over sixty years ago, with American Steel & Wire Company's wire, still in use and no strings broken



American Steel & Wire Company's Uniform Tension Scale

Better Methods and Better Pianos

As every great influence of civilization that, originating in the Old World, has been enhanced, enriched and well-nigh spiritualized by the application of American ingenuity, so the art of pianoforte building, coming to us with the foundation of exalted ideals and well established principles, has been ten fold magnified in scope of production and of ultimate artistic results by its later day evolution at the hands of the American craftsman, who is scale drawer, case designer or tone regulator.

From a well developed European "craft" of the early 19th century American genius and American enterprise have evolved a new world art-industry.

Recently a prominent piano manufacturer, in discussing the pronounced improvement in the tone quality of American pianos during the past few years, referred to the great service rendered the trade by the American Steel & Wire Company in its researches into the science of piano tone production. It was upwards of a half century ago that the Worcester mill turned out a piano wire radically different in character from that which we were importing from Europe. This wire was turned out at the specific requirements of one of the leading American piano makers of that day and it lacked the hardness and high tensile strength of the imported article. The makers advanced sound scientific reasons why the hard wire of high tensile strength was not only unnecessary but positively forbade the tone achievements which were the objects of the efforts of leading American piano makers.

Today the contentions of the American Steel & Wire Company in regard to the superiority of the low tension scale are generally admitted by leading piano manufacturers. But the corporation

did not stop with the establishing of the soundness of its tension theories. A few years ago, under the immediate direction of Frank E. Morton, Acoustical Engineer of the company, there was inaugurated a series of conferences with leading piano technicians with the idea of eliminating all guesswork in the production of pianos and substituting therefor exact knowledge.

As a result of this movement and the investigations prompted thereby, the vast majority of American piano manufacturers have at their disposal and are utilizing to a greater or lesser degree, a large number of facts which give them a clear conception as to the means for attaining their objectives. This has naturally brought about a pronounced improvement in the results. Heretofore, many manufacturers obtained the best results that they were able thru rather haphazard experimentation and methods that made necessary much that was unscientific in order to justify other erroneous calculations.

For many years the American Steel & Wire Company confined its interest in piano tone to wire alone. There came a time, however, when it was realized that it took more than good wire to produce a good piano. The wrong kind of hammer, improper action setting, faulty soundboard construction and scores of other elements entered into the proposition. Therefore, the American Steel & Wire Company, with rare but commendable enterprise, tackled the proposition in all of its fundamentals with the result that the piano manufacturing trade of the United States has been rendered a service that is hard to estimate.

The improvement in piano tone alone does not indicate the full benefits that the trade has derived from these activities of the American Steel & Wire Co. As these experiments and investigations and conferences have gradually brought to light the correct methods, there has been a great elimination of waste in piano factories, waste of effort in attempting to justify one erroneous method by another, the waste that invariably comes from guessing and trusting to luck for a result and the expensive procedure that increases the work of one department because of the use of wrong materials or methods by another. Certainly there is less waste and more efficiency in piano factories today than ever before in the history of the business and piano manufacture is measurably nearer an exact science than it was before the American Steel & Wire Company interested itself and piano technicians collectively in the discovery of the correct means to every end.

Piano wire is the aristocrat of all wire. Its drawing involves a refinement of the process of wire making untouched in the drawing of other wires. And the effort put forth by the American Steel & Wire Company to reach perfection in the manufacture of this piano wire, with its beautifully exact specifications, has served as an inspiration to all the wire mills in operation. When any limit of achievement in the drawing of wire is contemplated, the accomplishment of the piano wire mills is pointed out with the result that there has been a decided increase in the efficiency of all wire-drawing in the American Steel & Wire Company.

There are other benefits that accrue thru these activities of the American Steel & Wire Company which, while perhaps not as concrete as those mentioned above, are none the less important to the nation. This has to do with the manner in which an increased interest in music increases industrial efficiency. As the piano is the national instrument the foundation of an increased interest in music nationally is the economic production of piano tone as nearly perfect as is humanly possible. The increase in the utilization of music as a national recreation is undoubtedly worthy of the most serious consideration in its relation to industrial efficiency. Thus the activities of the American Steel & Wire Company in perfecting piano tone and increasing musical interest in the United States are making the employes of that company and every other organization more efficient.

It is to be hoped that the American Steel & Wire Company will continue its conferences with technicians and its investigations, for there is much yet to be done and the results are very obvious to the trade.

—*Piano Trade Magazine.*

Pipe Organ Wire

Modern organ mechanism is of wire. Round and flat wire; springs; wire rope; reinforcing wire; electrical wires, such as Americore rubber-covered for conveyance of current; magnet wire, silk-insulated, for releasing wind to pipes; paraffined cotton insulated, for connecting keyboards with stop action; console cables.

"American Piano Wire and Pipe Organ News,"
"Wood and the Piano Builders' Art," also
"Piano Tone Building"—sent free.

Services of our Acoustic Engineer
always available—free.

American Steel & Wire Company

Gauges, Sizes, Weights and Lengths of Round Wire

Steel, Iron, Copper and Aluminum

Diameters, from 1 inch to .000878 inch, Expressed in Inches and Millimeters

Basis of Computation

In computing Weights and Lengths, the following data are used, viz.:

	Specific Gravity	Weight per Cubic Inch (Pounds)
Copper	8.89	.3208
Iron and Steel . . .	7.843	.2830
Aluminum	2.67	.0963

A. G. Warren Tables Compiled 1899

Wire Gauges in Use

THE wire gauge for which sizes were shown heretofore in this Company's publications, under the title of "American Steel & Wire Co.'s Gauge," was the same as the Washburn & Moen gauge, and also the same as that used by practically all of the steel wire manufacturers of the United States, under various names. It results from this fact that there is really a standard steel wire gauge in the United States, although this has not been formally recognized.

Upon the recommendation of the Bureau of Standards at Washington, a number of the principal wire manufacturers and important consumers have agreed that it would be well to designate this gauge as the "Steel Wire Gauge"; in cases where it becomes necessary to distinguish it from the British Standard Wire Gauge, it may be called the "United States Steel Wire Gauge." The name thus adopted has official sanction, although without legal effect.

The only wire gauge which has been recognized in Acts of Congress is the Birmingham gauge. The Treasury Department has for many years used this gauge in connection with importations of Wire, and the adoption of succeeding tariff acts with provisions for the assessment of duty according to gauge numbers gives legislative sanction to the gauge.

Until certain provisions of the tariff act are amended, the Treasury Department probably cannot discontinue the use of the Birmingham gauge. It should, however, be abandoned by all other users, since the gauge itself is radically defective and is nearly obsolete, both in the United States and in Great Britian, where it originated.

For copper wires and wires of other metals the gauge universally recognized in the United States is the "American Wire Gauge," also known as the Brown & Sharpe. No confusion need arise between the Steel Wire Gauge and the American Wire Gauge, because the fields covered by the two gauges are distinct and definite.

We will designate these gauges as follows:

American Steel & Wire Company's Steel Wire Gauge for Steel Wire

American Wire Gauge (B. & S.) for Copper Wire

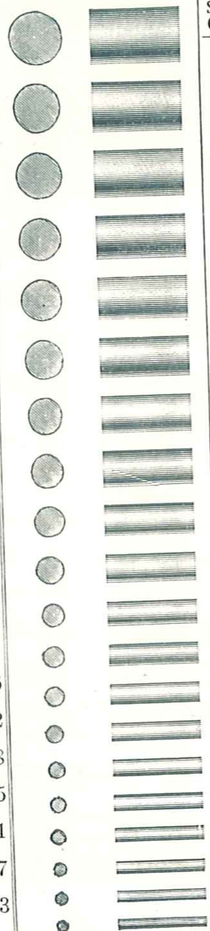
American Steel & Wire Company's Piano Wire Gauge for Piano Wire and Music Steel Wire

American Steel & Wire Company

Decimal Equivalents

1/64 = .0156	33/64 = .5156
1/32 = .0312	17/32 = .5312
3/64 = .0468	35/64 = .5468
1/16 = .0625	9/16 = .5625
5/64 = .0781	37/64 = .5781
3/32 = .0937	19/32 = .5937
7/64 = .1093	39/64 = .6093
1/8 = .125	5/8 = .625
9/64 = .1406	41/64 = .6406
5/32 = .1562	21/32 = .6562
11/64 = .1718	43/64 = .6718
3/16 = .1875	11/16 = .6875
13/64 = .2031	45/64 = .7031
7/32 = .2187	23/32 = .7187
15/64 = .2343	47/64 = .7343
1/4 = .25	3/4 = .75
17/64 = .2656	49/64 = .7656
9/32 = .2812	25/32 = .7812
19/64 = .2968	51/64 = .7968
5/16 = .3125	13/16 = .8125
21/64 = .3281	53/64 = .8281
11/32 = .3437	27/32 = .8437
23/64 = .3593	55/64 = .8593
3/8 = .375	7/8 = .875
25/64 = .3906	57/64 = .8906
13/32 = .4062	29/32 = .9062
27/64 = .4218	59/64 = .9218
7/16 = .4375	15/16 = .9375
29/64 = .4531	61/64 = .9531
15/32 = .4687	31/32 = .9687
31/64 = .4843	63/64 = .9843
1/2 = .5	1 = 1.0

Full Sizes of Plain Wire



American Steel & Wire Company's Steel Wire Gauge No.	Sizes of Wire (Inches): Common Fractions	Sizes of Wire (Inches): Decimally	Millimeters (Decimally)	Weight One Mile (Pounds)	Pounds per Foot	Feet to Pound
1		.2830	7.188	1128.0	.2136	4.681
	9/32	.28125		1114.0	.211	
2		.2625	6.668	970.4	.1838	5.441
	1/4	.250		880.2	.1667	
3		.2437	6.190	836.4	.1584	6.313
4		.2253	5.723	714.8	.1354	7.386
	7/32	.21875		673.9	.1276	
5		.2070	5.258	603.4	.1143	8.750
6		.1920	4.877	519.2	.0983	10.17
	3/16	.1875		495.1	.0937	
7		.1770	4.496	441.2	.0835	11.97
8		.1620	4.115	369.6	.070	14.29
	5/32	.15625		343.8	.0651	
9		.1483	3.767	309.7	.0586	17.05
10		.1350	3.429	256.7	.0486	20.57
	1/8	.1250		220.0	.0416	
11		.1205	3.061	204.5	.0387	25.82
12		.1055	2.680	156.7	.0296	33.69
	3/32	.09375		123.8	.0234	
13		.0915	2.324	117.9	.0223	44.78
14		.0800	2.032	90.13	.0170	58.58
15		.0720	1.829	73.01	.0138	72.32
16	1/16	.0625	1.588	55.0	.0104	95.98
17		.0540	1.372	41.07	.0077	128.6
18		.0475	1.207	31.77	.006	166.2
19		.0410	1.041	23.67	.0044	223.0
20		.0348	.8839	17.05	.0032	309.6
21		.0317	.8052	14.15	.002680	373.1
22		.0286	.7264	11.52	.002182	458.4
23		.0258	.6553	9.374	.001775	563.3
24		.0230	.5842	7.450	.001411	708.7
25		.0204	.5182	5.861	.001110	900.9
26		.0181	.4597	4.614	.0008738	1144.
27		.0173	.4394	4.215	.0007983	1253.
28		.0162	.4115	3.696	.0007000	1429.
29		.0150	.3810	3.169	.0006001	1666.
30		.0140	.3556	2.760	.0005228	1913.
31		.0132	.3353	2.454	.0004647	2152.
32		.0128	.3251	2.307	.0004370	2288.
33		.0118	.2997	1.961	.0003714	2693.
34		.0104	.2642	1.523	.0002885	3466.
35		.0095	.2413	1.271	.0002407	4154.
36		.0090	.2286	1.141	.0002160	4629.

GAUGE NUMBERS				DIAMETER					SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES										
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reductions by 64ths		Decimally	Millimeters (Decimally)		Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
				1		1.0000	25.40		.78540	1000000	1.895090	3.023	2.667	.9076
					63/64	.984375	25.00		.76105	968994.	.881412	2.930	2.585	.8795
				31/32		.96875	24.61		.73708	938477.	.867514	2.837	2.503	.8518
					61/64	.953125	24.21		.71349	908447.	.853390	2.747	2.423	.8245
				15/16		.9375	23.81		.69029	878906.	.839032	2.657	2.344	.7977
					59/64	.921875	23.42		.66747	849854.	.824434	2.570	2.267	.7713
				29/32		.90625	23.02		.64504	821289.	.809586	2.483	2.191	.7454
					57/64	.890625	22.62		.62299	793213.	.794480	2.398	2.116	.7199
				7/8		.8750	22.23		.60132	765625.	.779106	2.315	2.042	.6949
					55/64	.859375	21.83		.58004	738525.	.763456	2.233	1.970	.6703
				27/32		.84375	21.43		.55914	711914.	.747518	2.152	1.899	.6461
					53/64	.828125	21.03		.53862	685791.	.731282	2.073	1.829	.6224
				13/16		.8125	20.64		.51848	660156.	.714736	1.996	1.761	.5992
					51/64	.796875	20.24		.49874	635010.	.697870	1.920	1.694	.5763
				25/32		.78125	19.84		.47937	610352.	.680670	1.845	1.628	.5540
					49/64	.765625	19.45		.46039	586182.	.663122	1.772	1.563	.5320
				3/4		.7500	19.05		.44179	562500.	.645212	1.701	1.500	.5105
					47/64	.734375	18.65		.42357	539307.	.626926	1.631	1.438	.4895
				23/32		.71875	18.26		.40574	516602.	.608246	1.562	1.378	.4689
					45/64	.703125	17.86		.38829	494385.	.589156	1.495	1.319	.4487
				11/16		.6875	17.46		.37122	472656.	.569636	1.429	1.261	.4290
					43/64	.671875	17.07		.35454	451416.	.549666	1.365	1.204	4097
				21/32		.65625	16.67		.33824	430664.	.529228	1.302	1.149	3909
					41/64	.640625	16.27		.32233	410400.	.508298	1.241	1.095	.3725
				5/8		.6250	15.88		.30680	390625.	.486850	1.181	1.042	.3545
					39/64	.609375	15.48		.29165	371338.	.464860	1.123	.9904	.3370
				19/32		.59375	15.08		.27688	352539.	.442298	1.066	.9403	3200
	6/0					.5800	14.73		.26421	336400.	.421946	1.017	.8972	.3053
					37/64	.578125	14.68		.26250	334229.	.419134	1.011	.8915	.3033
				9/16		.5625	14.29		.24851	316406.	.395336	.9566	.8439	.2872
					35/64	.546875	13.89		.23489	299072.	.370866	.9042	.7977	.2714
				17/32		.53125	13.49		.22166	282227.	.345688	.8533	.7528	.2562
	5/0					.5165	13.12		.20952	266772.	.321230	.8066	.7115	.2421
					33/64	.515625	13.10		.20881	265869.	.319758	.8038	.7091	.2413
		5/0	7/0	1/2		.5000	12.70		.19635	250000.	.293030	.7559	.6668	.2269

GAUGE NUMBERS				DIAMETER				WEIGHT: Pounds per Mile			LENGTH: Feet per Pound		
				INCHES									
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reductions by 64ths		Decimally	Millimeters (Decimally)	Copper	Iron and Steel	Aluminum	Copper	Iron and Steel	Aluminum
				1		1.0000	25.40	15964.	14083.	4792.	.3307	.3749	1.102
					63/64	.984375	25.00	15469.	13646.	4644.	.3413	.3869	1.137
				31/32		.96875	24.61	14982.	13216.	4497.	.3524	.3995	1.174
					61/64	.953125	24.21	14502.	12793.	4353.	.3641	.4127	1.213
				15/16		.9375	23.81	14031.	12377.	4212.	.3763	.4266	1.254
					59/64	.921875	23.42	13567.	11968.	4073.	.3892	.4412	1.296
				29/32		.90625	23.02	13111.	11566.	3936.	.4027	.4565	1.342
					57/64	.890625	22.62	12663.	11171.	3801.	.4170	.4727	1.389
				7/8		.8750	22.23	12222.	10782.	3669.	.4320	.4897	1.439
					55/64	.859375	21.83	11790.	10401.	3539.	.4478	.5077	1.492
				27/32		.84375	21.43	11365.	10026.	3412.	.4646	.5266	1.548
					53/64	.828125	21.03	10948.	9658.	3286.	.4823	.5467	1.607
				13/16		.8125	20.64	10539.	9297.	3164.	.5010	.5679	1.669
					51/64	.796875	20.24	10137.	8943.	3043.	5209	.5904	1.735
				25/32		.78125	19.84	9744.	8596.	2925.	.5419	.6143	1.805
					49/64	.765625	19.45	9358.	8255.	2809.	.5642	.6396	1.880
				3/4		.7500	19.05	8980.	7922.	2696.	.5880	.6665	1.959
					47/64	.734375	18.65	8609.	7595.	2584.	.6133	.6952	2.043
				23/32		.71875	18.26	8247.	7275.	2476.	.6402	.7258	2.133
					45/64	.703125	17.86	7892.	6962.	2369.	.6690	.7584	2.229
				11/16		.6875	17.46	7545.	6656.	2265.	.6998	.7932	2.331
					43/64	.671875	17.07	7206.	6357.	2163.	.7327	.8306	2.441
				21/32		.65625	16.67	6875.	6065.	2064.	.7680	.8706	2.558
					41/64	.640625	16.27	6552.	5780.	1967.	.8059	.9136	2.685
				5/8		.6250	15.88	6236.	5501.	1872.	.8467	.9598	2.821
					39/64	.609375	15.48	5928.	5230.	1780.	.8907	1.010	2.967
				19/32		.59375	15.08	5628.	4965.	1689.	.9382	1.063	3.125
	6/0					.5800	14.73	5370.	4737.	1612.	.9832	1.115	3.275
					37/64	.578125	14.68	5336.	4707.	1602.	.9896	1.122	3.297
				9/16		.5625	14.29	5051.	4456.	1516.	1.045	1.185	3.482
					35/64	.546875	13.89	4774.	4212.	1433.	1.106	1.254	3.684
				17/32		.53125	13.49	4505.	3975.	1352.	1.172	1.328	3.904
	5/0					.5165	13.12	4259.	3757.	1278.	1.240	1.405	4.130
					33/64	.515625	13.10	4244.	3744.	1274.	1.244	1.410	4.144
		5/0	7/0	1/2		.5000	12.70	3991.	3521.	1198.	1.323	1.500	4.407

GAUGE NUMBERS				DIAMETER				SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES									
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths		Decimally	Millimeters (Decimally)	Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
7/0						.4900	12.45	.18857	240100.	$\bar{1}$.275482	.7259	.6404	.2179
					31/64	.484375	12.30	.18427	234619.	.265454	.7094	.6258	.2129
				15/32		.46875	11.91	.17257	219727.	.236972	.6643	.5861	.1994
			6/0			.4640	11.79	.16909	215296.	.228126	.6509	.5742	.1954
6/0						.4615	11.72	.16728	212982.	.223434	.6439	.5681	.1933
	4/0					.4600	11.68	.16619	211600.	.220606	.6398	.5644	1920
		4/0				.4540	11.53	.16188	206116.	.209202	.6232	.5498	.1871
					29/64	.453125	11.51	.16126	205322.	.207526	.6208	.5476	.1864
				7/16		.4375	11.11	.15033	191406.	.177046	.5787	.5105	.1737
			5/0			.4320	10.97	.14657	186624.	.166058	.5643	.4978	.1694
5/0						.4305	10.93	.14556	185330.	.163036	.5603	.4943	.1682
		3/0				.4250	10.80	.14186	180625.	.151868	.5461	.4818	.1639
					27/64	.421875	10.72	.13978	177979	.145458	.5381	.4747	.1615
	3/0					.4096	10.40	.13177	167772.	.119810	.5073	.4475	.1523
				13/32		.40625	10.32	.12962	165039.	.112676	.4990	.4402	.1498
			4/0			.4000	10.16	.12566	160000.	.099210	.4838	.4268	.1452
4/0						.3938	10.00	.12180	155078	.085642	.4689	.4136	.1408
					25/64	.390625	9.922	.11984	152588	.078610	.4613	.4070	.1385
		2/0				.3800	9.652	.11341	144400.	.054658	.4366	.3851	.1311
				3/8		.3750	9.525	.11045	140625	.043152	.4252	.3751	.1276
			3/0			.3720	9.449	.10869	138384.	.036176	.4184	.3691	.1256
	2/0					.3648	9.266	.10452	133079	.019200	.4024	.3550	.1208
3/0						.3625	9.208	.10321	131406.	.013706	.3973	.3505	.1193
					23/64	.359375	9.128	.10143	129150.	.006186	.3905	.3445	.1172
			2/0			.3480	8.839	.095115	121104	$\bar{2}$.978248	.3662	.3230	.1099
				11/32		.34375	8.731	.092806	118164.	.967576	.3573	.3152	.1072
		1/0				.3400	8.636	.090792	115600	.958048	.3495	.3083	.1049
2/0						.3310	8.407	.086049	109561.	.934746	.3313	.2922	.09944
					21/64	.328125	8.334	.084561	107666.	.927168	.3255	.2872	.09772
	1/0					.3249	8.252	.082907	105560.	.918590	.3192	.2816	.09581
			1/0			.3240	8.230	.082448	104976.	.916180	.3174	.2800	.09528
				5/16		.3125	7.938	.076699	97656.	.884790	.2953	.2605	.08803
1/0						.3065	7.785	.073782	93942.	.867950	.2840	.2506	.08526
		1	1			.3000	7.620	.070686	90000.	.849332	.2721	.2400	.08168
					19/64	.296875	7.541	.0692	88135.	.840238	.2665	.2351	.07999

GAUGE NUMBERS				DIAMETER			WEIGHT: Pounds per Mile			LENGTH: Feet per Pound		
				INCHES								
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths	Decimally	Millimeters (Decimally)	Copper	Iron and Steel	Aluminum	Copper	Iron and Steel	Aluminum
7/0					.4900	12.45	3833.	3381.	1151.	1.378	1.562	4.589
				31/64	.484375	12.30	3745.	3304.	1124.	1.410	1.598	4.696
				15/32	.46875	11.91	3508.	3094.	1053.	1.505	1.706	5.014
			6/0		.4640	11.79	3437.	3032.	1032.	1.536	1.741	5.118
6/0					.4615	11.72	3400.	2999.	1021.	1.553	1.760	5.173
	4/0				.4600	11.68	3378.	2980.	1014.	1.563	1.772	5.207
		4/0			.4540	11.53	3290.	2903.	987.7	1.605	1.819	5.346
				29/64	.453125	11.51	3278.	2892	983.9	1.611	1.826	5.366
				7/16	.4375	11.11	3056.	2696.	917.2	1.728	1.959	5.756
			5/0		.4320	10.97	2979.	2628.	894.3	1.772	2.009	5.904
5/0					.4305	10.93	2959.	2610.	888.1	1.785	2.023	5.945
		3/0			.4250	10.80	2883.	2544.	865.6	1.831	2.076	6.100
				27/64	.421875	10.72	2841.	2506.	852.9	1.858	2.107	6.191
	3/0				.4096	10.40	2678.	2363.	804.0	1.971	2.235	6.567
				13/32	.40625	10.32	2635.	2324.	790.9	2.004	2.272	6.676
			4/0		.4000	10.16	2554.	2253.	766.7	2.067	2.343	6.886
4/0					.3938	10.00	2476.	2184.	743.2	2.133	2.418	7.105
				25/64	.390625	9.922	2436.	2149.	731.2	2.168	2.457	7.221
		2/0			.3800	9.652	2305.	2034.	692.0	2.290	2.596	7.630
				3/8	.3750	9.525	2245.	1980.	673.9	2.352	2.666	7.835
			3/0		.3720	9.449	2209.	1949.	663.2	2.390	2.709	7.962
	2/0				.3648	9.266	2124.	1874.	637.7	2.485	2.817	8.279
3/0					.3625	9.208	2098.	1851.	629.7	2.517	2.853	8.385
				23/64	.359375	9.128	2062.	1819.	618.9	2.561	2.903	8.531
			2/0		.3480	8.839	1933.	1705.	580.4	2.731	3.096	9.098
				11/32	34375	8.731	1886.	1664.	566.3	2.799	3.173	9.324
		1/0			.3400	8.636	1845.	1628.	554.0	2.861	3.243	9.531
2/0					.3310	8.407	1749.	1543.	525.0	3.019	3.422	10.06
				21/64	.328125	8.334	1719.	1516	516 0	3.072	3.482	10.23
	1/0				.3249	8.252	1685.	1487.	505.9	3.133	3.552	10.44
			1/0		.3240	8.230	1676.	1478.	503.1	3.151	3.572	10.50
				5/16	.3125	7.938	1599.	1375.	468.0	3.387	3.839	11.28
1/0					.3065	7.785	1500.	1323.	450.2	3.521	3.991	11.73
		1	1		.3000	7.620	1437.	1267.	431.3	3.675	4.166	12.24
				19/64	.296875	7.541	1407.	1241	422.4	3.753	4.254	12.50

GAUGE NUMBERS				DIAMETER				SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES									
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths		Decimally	Millimeters (Decimally)	Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
	1					.2893	7.348	.065733	83694.	$\bar{2}$.817786	.2530	.2232	.07596
		2				.2840	7.214	.063347	80656.	.801726	.2439	.2151	.07320
1						.2830	7.188	.062902	80089.	.798662	.2421	.2136	.07269
				9/32		.28125	7.144	.062126	79102.	.793276	.2392	.2110	.07179
			2			.2760	7.010	.059829	76176.	.776908	.2303	.2032	.06914
					17/64	.265625	6.747	.055415	70557.	.743628	.2133	.1882	.06404
2						.2625	6.668	.054119	68906.	.733348	.2083	.1838	.06254
		3				.2590	6.579	.052685	67081.	.721690	.2028	.1789	.06088
	2					.2576	6.543	.052117	66358.	.716982	.2006	.1770	.06023
			3			.2520	6.401	.049876	63504.	.697892	.1920	.1694	.05764
				1/4		.2500	6.350	.049087	62500.	.690970	.1890	.1667	.05673
3						.2437	6.190	.046645	59390.	.668802	.1796	.1584	.05390
		4				.2380	6.045	.044488	56644.	.648244	.1713	.1511	.05141
					15/64	.234375	5.953	.043143	54932.	.634912	.1661	.1465	.04986
			4			.2320	5.893	.042273	53824.	.626066	.1627	.1436	.04885
	3					.2294	5.827	.041331	52624.	.616276	.1591	.1404	.04776
4						.2253	5.723	.039867	50760.	.600612	.1535	.1354	.04607
		5				.2200	5.588	.038013	48400.	.579936	.1463	.1291	.04393
				7/32		.21875	5.556	.037583	47852.	.574986	.1447	.1276	.04343
			5			.2120	5.385	.035299	44944.	.547762	.1359	.1199	.04079
5						.2070	5.258	.033654	42849.	.527030	.1296	.1143	.03889
	4					.2043	5.189	.032781	41738.	.515626	.1262	.1113	.03788
					13/64	.203125	5.159	.032405	41260.	.510616	.1247	.1101	.03745
		6				.2030	5.156	.032366	41209.	.510082	.1246	.1099	.03740
6			6			.1920	4.877	.028953	36864.	.461692	.1115	.09832	.03346
				3/16		.1875	4.763	.027612	35156.	.441092	.1063	.09377	.03191
	5					.1819	4.620	.025987	33088.	.414756	.1000	.08825	.03003
		7				.1800	4.572	.025447	32400.	.405636	.09796	.08642	.02941
7						.1770	4.496	.024606	31329.	.391036	.09472	.08356	.02843
			7			.1760	4.470	.024329	30976.	.386116	.09366	.08262	.02811
					11/64	.171875	4.366	.023201	29541.	.365516	.08932	.07879	.02681
		8				.1650	4.191	.021383	27225.	.330058	.08231	.07261	.02471
8	6					.1620	4.115	.020612	26244.	.314120	.07935	.07000	.02382
			8			.1600	4.064	.020106	25600.	.303330	.07740	.06828	.02323
				5/32		.15625	3.969	.019175	24414.	.282730	.07382	.06512	.02216

GAUGE NUMBERS				DIAMETER			WEIGHT: Pounds per Mile			LENGTH: Feet per Pound		
				INCHES								
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths	Decimally	Millimeters (Decimally)	Copper	Iron and Steel	Aluminum	Copper	Iron and Steel	Aluminum
	1				.2893	7.348	1336.	1179.	401.1	3.952	4.480	13.16
		2			.2840	7.214	1288.	1136.	386.5	4.101	4.648	13.66
1					.2830	7.188	1279.	1128.	383.8	4.130	4.681	13.76
				9/32	.28125	7.144	1263.	1114.	379.1	4.181	4.740	13.93
			2		.2760	7.010	1216.	1073.	365.0	4.342	4.922	14.46
				17/64	.265625	6.747	1126.	993.6	338.1	4.688	5.314	15.62
2					.2625	6.668	1100.	970.4	330.2	4.800	5.441	15.99
		3			.2590	6.579	1071.	944.7	321.5	4.931	5.589	16.42
	2				.2576	6.543	1059.	934.5	318.0	4.984	5.650	16.60
			3		.2520	6.401	1014.	894.3	304.3	5.208	5.904	17.35
				1/4	.2500	6.350	997.7	880.2	299.5	5.292	5.999	17.63
3					.2437	6.190	948.1	836.4	284.6	5.569	6.313	18.55
		4			.2380	6.045	904.3	797.7	271.4	5.839	6.619	19.45
				15/64	.234375	5.953	876.9	773.6	263.2	6.021	6.825	20.06
			4		.2320	5.893	859.2	758.0	257.9	6.145	6.966	20.47
	3				.2294	5.827	840.1	741.1	252.2	6.285	7.125	20.94
4					.2253	5.723	810.3	714.8	243.3	6.516	7.386	21.71
		5			.2200	5.588	772.7	681.6	231.9	6.834	7.746	22.76
				7/32	.21875	5.556	763.9	673.9	229.3	6.912	7.835	23.03
			5		.2120	5.385	717.5	632.9	215.4	7.359	8.342	24.51
5					.2070	5.258	684.0	603.4	205.3	7.719	8.750	25.71
	4				.2043	5.189	666.3	587.8	200.0	7.924	8.983	26.40
				13/64	.203125	5.159	658.7	581.1	197.7	8.016	9.087	26.70
		6			.2030	5.156	657.9	580.3	197.5	8.026	9.098	26.74
6			6		.1920	4.877	588.5	519.2	176.7	8.972	10.17	29.89
				3/16	.1875	4.763	561.2	495.1	168.5	9.408	10.66	31.34
	5				.1819	4.620	528.2	466.0	158.6	9.996	11.33	33.30
		7			.1800	4.572	517.2	456.3	155.3	10.21	11.57	34.01
7					.1770	4.496	500.1	441.2	150.1	10.56	11.97	35.17
			7		.1760	4.470	494.5	436.2	148.4	10.68	12.10	35.57
				11/64	.171875	4.366	471.6	416.0	141.6	11.20	12.69	37.30
		8			.1650	4.191	434.6	383.4	130.5	12.15	13.77	40.47
8	6				.1620	4.115	419.0	369.6	125.8	12.60	14.29	41.98
			8		.1600	4.064	408.7	360.5	122.7	12.92	14.65	43.04
				5/32	.15625	3.969	389.7	343.8	117.0	13.55	15.36	45.13

GAUGE NUMBERS				DIAMETER				SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES									
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stub	British Imperial Standard	Reduction by 64ths		Decimally	Millimeters (Decimally)	Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
9						.1483	3.767	.017273	21993.	$\bar{2}$.237372	.06649	.05866	.01996
		9				.1480	3.759	.017203	21904.	.235614	.06623	.05842	.01988
	7					.1443	3.665	.016354	20822.	.213622	.06296	.05554	.01890
			9			.1440	3.658	.016286	20736.	.211814	.06269	.05531	.01882
					9/64	.140625	3.572	.015532	19775.	.191216	.05979	.05275	.01795
10						.1350	3.429	.014314	18225.	.155758	.05510	.04861	.01654
		10				.1340	3.404	.014103	17956.	.149300	.05429	.04789	.01630
	8					.1285	3.264	.012969	16512.	.112896	.04992	.04404	.01499
			10			.1280	3.251	.012868	16384.	.109510	.04954	.04370	.01487
				1/8		.1250	3.175	.012272	15625.	.088910	.04724	.04168	.01418
11						.1205	3.061	.011404	14520.	.057064	.04390	.03873	.01318
		11				.1200	3.048	.011310	14400.	.053452	.04354	.03841	.01307
			11			.1160	2.946	.010568	13456.	.024006	.04068	.03589	.01221
	9					.1144	2.906	.010279	13087.	.011942	.03957	.03491	.01188
					7/64	.109375	2.778	.0093956	11963.	$\bar{3}$.972926	.03617	.03191	.01086
		12				.1090	2.769	.0093313	11881.	.969942	.03592	.03169	.01078
12						.1055	2.680	.0087417	11130.	.941594	.03365	.02969	.01010
			12			.1040	2.642	.0084949	10816.	.929156	.03270	.02885	.009817
	10					.1019	2.588	.0081553	10384.	.911438	.03139	.02770	.009424
		13				.0950	2.413	.0070882	9025.0	.850538	.02729	.02407	.008191
				3/32		.09375	2.381	.0069029	8789.1	.839032	.02657	.02344	.007977
			13			.0920	2.337	.0066476	8464.0	.822666	.02559	.02258	.007682
13						.0915	2.324	.0065755	8372.3	.817932	.02531	.02233	.007599
	11					.0907	2.304	.0064611	8226.5	.810304	.02487	.02194	.007466
		14				.0830	2.108	.0054106	6889.0	.733246	.02083	.01837	.006252
	12					.0808	2.052	.0051276	6528.6	.709912	.01974	.01741	.005925
14			14			.0800	2.032	.0050266	6400.0	.701270	.01935	.01707	.005809
					5/64	.078125	1.984	.0047937	6103.5	.680670	.01845	.01628	.005540
15	13	15	15			.0720	1.829	.0040715	5184.0	.609754	.01567	.01383	.004705
		16				.0650	1.651	.0033183	4225.0	.520916	.01277	.01127	.003835
	14					.0641	1.628	.0032271	4108.8	.508806	.01242	.01096	.003729
			16			.0640	1.626	.0032170	4096.0	.507450	.01238	.01092	.003718
16				1/16		.0625	1.588	.0030680	3906.3	.486850	.01181	.01042	.003545
		17				.0580	1.473	.0026421	3364.0	.421946	.01017	.008972	.003053
	15					.0571	1.450	.0025607	3260.4	.408362	.009858	.008696	.002959

GAUGE NUMBERS				DIAMETER				WEIGHT: Pounds per Mile			LENGTH: Feet per Pound		
				INCHES									
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths		Decimally	Millimeters (Decimally)	Copper	Iron and Steel	Aluminum	Copper	Iron and Steel	Aluminum
9						.1483	3.767	351.1	309.7	105.4	15.04	17.05	50.10
		9				.1480	3.759	349.7	308.5	105.0	15.10	17.12	50.30
	7					.1443	3.665	332.4	293.2	99.78	15.88	18.01	52.91
			9			.1440	3.658	331.0	292.0	99.37	15.95	18.08	53.13
					9/64	.140625	3.572	315.7	278.5	94.77	16.73	18.96	55.72
10						.1350	3.429	290.9	256.7	87.34	18.15	20.57	60.46
		10				.1340	3.404	286.6	252.9	86.05	18.42	20.88	61.36
	8					.1285	3.264	263.6	232.5	79.13	20.03	22.71	66.73
			10			.1280	3.251	261.6	230.7	78.51	20.19	22.88	67.25
				1/8		.1250	3.175	249.4	220.0	74.88	21.17	24.00	70.52
11						.1205	3.061	231.8	204.5	69.58	22.78	25.82	75.88
		11				.1200	3.048	229.9	202.8	69.01	22.97	26.04	76.51
			11			.1160	2.946	214.8	189.5	64.48	24.58	27.86	81.88
	9					.1144	2.906	208.9	184.3	62.72	25.27	28.65	84.19
					7/64	.109375	2.778	191.0	168.5	57.33	27.65	31.34	92.10
		12				.1090	2.769	189.7	167.3	56.94	27.84	31.56	92.74
12						.1055	2.680	177.7	156.7	53.34	29.72	33.69	98.99
			12			.1040	2.642	172.7	152.3	51.83	30.58	34.66	101.9
	10					.1019	2.588	165.8	146.2	49.76	31.85	36.11	106.1
		13				.0950	2.413	144.1	127.1	43.25	36.65	41.54	122.1
				3/32		.09375	2.381	140.3	123.8	42.12	37.63	42.66	125.4
			13			.0920	2.337	135.1	119.2	40.56	39.08	44.30	130.2
13						.0915	2.324	133.7	117.9	40.12	29.51	44.78	131.6
	11					.0907	2.304	131.3	115.9	39.42	40.21	45.58	133.9
		14				.0830	2.108	110.0	97.02	33.01	48.01	54.42	159.9
	12					.0808	2.052	104.2	91.94	31.29	50.66	57.43	168.8
14			14			.0800	2.032	102.2	90.13	30.67	51.68	58.58	172.2
					5/64	.078125	1.984	97.44	85.96	29.25	54.19	61.43	180.5
15	13	15	15			.0720	1.829	82.76	73.01	24.84	63.80	72.32	212.5
		16				.0650	1.651	67.45	59.50	20.25	78.28	88.74	260.8
	14					.0641	1.628	65.59	57.86	19.69	80.50	91.25	268.2
			16			.0640	1.626	65.39	57.68	19.63	80.75	91.53	269.0
16				1/16		.0625	1.588	62.36	55.01	18.72	84.67	95.98	282.1
		17				.0580	1.473	53.70	47.37	16.12	98.32	111.5	327.5
	15					.0571	1.450	52.05	45.92	15.62	101.4	115.0	337.9

GAUGE NUMBERS				DIAMETER			SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES								
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths	Decimally	Millimeters (Decimally)	Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
			17		.0560	1.422	.0024630	3136.0	$\bar{3}$.391466	.009482	.008364	.002846
17					.0540	1.372	.0022902	2916.0	.359878	.008816	.007778	.002647
	16				.0508	1.290	.0020268	2580.6	.306818	.007802	.006883	.002342
		18			.0490	1.245	.0018857	2401.0	.275482	.007259	.006404	.002179
			18		.0480	1.219	.0018096	2304.0	.257572	.006966	.006145	.002091
18					.0475	1.207	.0017721	2256.3	.248478	.006822	.006018	.002048
				3/64	.046875	1.191	.0017257	2197.3	.236972	.006643	.005861	.001994
	17				.0453	1.151	.0016117	2052.1	.207286	.006204	.005473	.001862
		19			.0420	1.067	.0013854	1764.0	.141588	.005333	.004705	.001601
19					.0410	1.041	.0013203	1681.0	.120658	.005082	.004484	.001526
	18				.0403	1.024	.0012756	1624.1	.105700	.004910	.004332	.001474
			19		.0400	1.016	.0012566	1600.0	.099210	.004838	.004268	.001452
			20		.0360	.9144	.0010179	1296.0	.007696	.003918	.003457	.001176
	19				.0359	.9119	.0010122	1288.8	.005278	.003897	.003438	.001170
		20			.0350	.8890	.00096211	1225.0	$\bar{4}$.983226	.003704	.003267	.001112
20					.0348	.8839	.00095115	1211.0	.978248	.003662	.003230	.001099
	20	21	21		.0320	.8128	.00080425	1024.0	.905390	.003096	.002731	.0009294
21					.0317	.8052	.00078924	1004.9	.897208	.003038	.002680	.0009120
				1/32	.03125	.7938	.00076699	976.56	.884790	.002953	.002605	.0008863
22					.0286	.7264	.00064242	817.96	.807822	.002473	.002182	.0007424
	21				.0285	.7239	.00063794	812.25	.804780	.002456	.002166	.0007372
		22	22		.0280	.7112	.00061575	784.00	.789406	.002370	.002091	.0007116
23					.0258	.6553	.00052279	665.64	.718330	.002013	.001775	.0006041
	22				.0253	.6426	.00050273	640.09	.701332	.001935	.001707	.0005810
		23			.0250	.6350	.00049087	625.00	.690970	.001890	.001667	.0005673
			23		.0240	.6096	.00045239	576.00	.655512	.001742	.001536	.0005228
24					.0230	.5842	.00041548	529.00	.618546	.001599	.001411	.0004801
	23				.0226	.5740	.00040115	510.76	.603306	.001544	.001362	.0004636
		24	24		.0220	.5588	.00038013	484.00	.579936	.001463	.001291	.0004393
25					.0204	.5182	.00032685	416.16	.514350	.001258	.001110	.0003777
	24				.0201	.5105	.00031731	404.01	.501482	.001222	.001078	.0003667
		25	25		.0200	.5080	.00031416	400.00	.497150	.001209	.001067	.0003630
26					.0181	.4597	.00025730	327.61	.410448	.0009905	.0008738	.0002973
		26	26		.0180	.4572	.00025447	324.00	.405636	.0009796	.0008612	.0002941
	25				.0179	.4547	.00025165	320.41	.400796	.0009688	.0008546	.0002908

GAUGE NUMBERS				DIAMETER				WEIGHT: Pounds per Mile			LENGTH: Feet per Pound		
				INCHES									
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths		Decimally	Millimeters (Decimally)	Copper	Iron and Steel	Aluminum	Copper	Iron and Steel	Aluminum
			17			.0560	1.422	50.06	44.16	15.03	105.5	119.6	351.3
17						.0540	1.372	46.55	41.07	13.97	113.4	128.6	377.8
	16					.0508	1.290	41.20	36.34	12.37	128.2	145.3	426.9
		18				.0490	1.245	38.33	33.81	11.51	137.8	156.2	458.9
			18			.0480	1.219	36.78	32.45	11.04	143.6	162.7	478.2
18						.0475	1.207	36.02	31.77	10.81	146.6	166.2	488.3
					3/64	.046875	1.191	35.08	30.94	10.53	150.5	170.6	501.4
	17					.0453	1.151	32.76	28.90	9.834	161.2	182.7	536.9
		19				.0420	1.067	28.16	24.84	8.453	187.5	212.5	624.6
19						.0410	1.041	26.84	23.67	8.056	196.8	223.0	655.4
	18					.0403	1.024	25.93	22.87	7.783	203.7	230.9	678.4
			19			.0400	1.016	25.54	22.53	7.667	206.7	234.3	688.6
			20			.0360	.9144	20.69	18.25	6.211	255.2	289.3	850.2
	19					.0359	.9119	20.57	18.15	6.176	256.6	290.9	854.9
		20				.0350	.8890	19.56	17.25	5.870	270.0	306.1	899.4
20						.0348	.8839	19.33	17.05	5.804	273.1	309.6	909.8
	20	21	21			.0320	.8128	16.35	14.42	4.907	323.0	366.1	1076.
21						.0317	.8052	16.04	14.15	4.816	329.1	373.1	1096.
				1/32		.03125	.7938	15.59	13.75	4.680	338.7	383.9	1128.
22						.0286	.7264	13.06	11.52	3.920	404.4	458.4	1347.
	21					.0285	.7239	12.97	11.44	3.892	407.2	461.6	1356.
		22	22			.0280	.7112	12.52	11.04	3.757	421.9	478.2	1405.
23						.0258	.6553	10.63	9.374	3.190	496.9	563.3	1655.
	22					.0253	.6426	10.22	9.014	3.067	516.7	585.7	1721.
		23				.0250	.6350	9.977	8.802	2.995	529.2	599.9	1763.
			23			.0240	.6096	9.195	8.112	2.760	574.2	650.9	1913.
24						.0230	.5842	8.445	7.450	2.535	625.2	708.7	2083.
	23					.0226	.5740	8.154	7.193	2.448	647.6	734.1	2157.
		24	24			.0220	.5588	7.727	6.816	2.319	683.4	774.6	2276.
25						.0204	.5182	6.644	5.861	1.994	794.8	900.9	2648
	24					.0201	.5105	6.450	5.690	1.936	818.7	928.0	2727.
		25	25			.0200	.5080	6.386	5.633	1.917	826.9	937.3	2755.
26						.0181	.4597	5.230	4.614	1.570	1010.	1144.	3363.
		26	26			.0180	.4572	5.172	4.563	1.553	1021.	1157.	3401.
	25					.0179	.4547	5.115	4.512	1.535	1032.	1170.	3439.

GAUGE NUMBERS				DIAMETER			SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES								
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reductions by 64ths	Decimally	Millimeters (Decimally)	Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
27					.0173	.4394	.00023506	299.29	$\bar{4}$.371182	.0009049	.0007983	.0002716
			27		.0164	.4166	.00021124	268.96	.324778	.0008132	.0007174	.0002441
28					.0162	.4115	.00020612	262.44	.314120	.0007935	.0007000	.0002382
		27			.0160	.4064	.00020106	256.00	.303330	.0007740	.0006828	.0002323
	26				.0159	.4039	.00019856	252.81	.297884	.0007644	.0006743	.0002295
				1/64	.015625	.3969	.00019175	244.14	.282730	.0007382	.0006512	.0002216
29					.0150	.3810	.00017671	225.00	.247272	.0006803	.0006001	.0002042
			28		.0148	.3759	.00017203	219.04	.235614	.0006623	.0005842	.0001988
	27				.0142	.3607	.00015837	201.64	.199666	.0006097	.0005378	.0001830
30		28			.0140	.3556	.00015394	196.00	.187346	.0005926	.0005228	.0001779
			29		.0136	.3454	.00014527	184.96	.162168	.0005592	.0004933	.0001679
31					.0132	.3353	.00013685	174.24	.136238	.0005268	.0004647	.0001581
		29			.0130	.3302	.00013273	169.00	.122976	.0005110	.0004508	.0001534
32					.0128	.3251	.00012868	163.84	.109510	.0004954	.0004370	.0001487
	28				.0126	.3200	.00012469	158.76	.095832	.0004800	.0004234	.0001441
			30		.0124	.3150	.00012076	153.76	.081934	.0004649	.0004101	.0001396
		30			.0120	.3048	.00011310	144.00	.053452	.0004354	.0003841	.0001307
33					.0118	.2997	.00010936	139.24	.038854	.0004210	.0003714	.0001264
			31		.0116	.2946	.00010568	134.56	.024006	.0004068	.0003580	.0001221
	29				.0113	.2870	.00010029	127.69	.001246	.0003861	.0003406	.0001159
			32		.0108	.2743	.000091609	116.64	$\bar{5}$.961938	.0003527	.0003111	.0001059
34					.0104	.2642	.000084949	108.16	.929156	.0003270	.0002885	.00009817
	30	31	33		.0100	.2540	.000078540	100.00	.895090	.0003023	.0002667	.00009076
35					.0095	.2413	.000070882	90.25	.850538	.0002729	.0002407	.00008191
			34		.0092	.2337	.000066476	84.64	.822666	.0002559	.0002258	.00007682
36		32			.0090	.2286	.000063617	81.00	.803576	.0002449	.0002160	.00007352
	31				.00893	.2268	.000062631	79.74	.796792	.0002411	.0002127	.00007238
37					.0085	.2159	.000056745	72.25	.753928	.0002184	.0001927	.00006557
			35		.0084	.2134	.000055418	70.56	.743648	.0002133	.0001882	.00006404
38		33			.0080	.2032	.000050266	64.00	.701270	.0001935	.0001707	.00005809
	32				.00795	.2019	.000049639	63.20	.695824	.0001911	.0001686	.00005736
			36		.0076	.1930	.000045365	57.76	.656718	.0001746	.0001541	.00005242
39					.0075	.1905	.000044179	56.25	.645212	.0001701	.0001500	.00005105
	33				.00708	.1798	.000039369	50.13	.595156	.0001516	.0001337	.00004549
40		34			.0070	.1778	.000038485	49.00	.585286	.0001481	.0001307	.00004447

GAUGE NUMBERS: American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	DIAMETER, INCHES: Reductions by 64ths	Decimally	Millimeters (Decimally)	WEIGHT: Pounds per Mile, Copper	Iron and Steel	Aluminum	LENGTH: Feet per Pound, Copper	Iron and Steel	Aluminum
27					.0173	.4394	4.778	4.215	1.434	1105.	1253.	3681.
			27		.0164	.4166	4.294	3.788	1.289	1230.	1394.	4097.
28					.0162	.4115	4.190	3.696	1.258	1260.	1429.	4198.
		27			.0160	.4064	4.087	3.605	1.227	1292.	1465.	4304.
	26				.0159	.4039	4.036	3.560	1.212	1308.	1483.	4358.
				1/64	.015625	.3969	3.897	3.438	1.170	1355.	1536.	4513.
29					.0150	.3810	3.592	3.169	1.078	1470.	1666.	4897.
			28		.0148	.3759	3.497	3.085	1.050	1510.	1712.	5030.
	27				.0142	.3607	3.219	2.840	.9663	1640.	1859.	5464.
30		28			.0140	.3556	3.129	2.760	.9393	1687.	1913.	5621.
			29		.0136	.3454	2.953	2.605	.8864	1788.	2027.	5957.
31					.0132	.3353	2.782	2.454	.8350	1898.	2152.	6323.
		29			.0130	.3302	2.698	2.380	.8099	1957.	2218.	6520.
32					.0128	.3251	2.616	2.307	.7851	2019.	2288.	6725
	28				.0126	.3200	2.534	2.236	.7608	2083.	2362.	6940.
			30		.0124	.3150	2.455	2.165	.7368	2151.	2438.	7166.
		30			.0120	.3048	2.299	2.028	.6901	2297.	2604.	7651.
33					.0118	.2997	2.223	1.961	.6673	2375.	2693.	7913.
			31		.0116	.2946	2.148	1.895	.6448	2458.	2786.	8188.
	29				.0113	.2870	2.038	1.798	.6119	2590.	2936.	8629.
			32		.0108	.2743	1.862	1.643	.5590	2836.	3214.	9446.
34					.0104	.2642	1.727	1.523	.5183	3058.	3466.	10187.
	30	31	33		.0100	.2540	1.596	1.408	.4792	3307.	3749.	11018.
35					.0095	.2413	1.441	1.271	.4325	3665.	4154.	12208.
			34		.0092	.2337	1.351	1.192	.4056	3908.	4430.	13017.
36		32			.0090	.2286	1.293	1.141	.3882	4083.	4629.	13602.
	31				00893	.2268	1.273	1.123	.3821	4148.	4702.	13817.
37					.0085	.2159	1.153	1.017	.3462	4578.	5189.	15250.
			35		.0084	.2134	1.126	.9937	.3381	4687.	5314.	15615.
38		33			.0080	.2032	1.022	.9013	.3067	5168.	5858.	17216.
	32				.00795	.2019	1.009	.8901	.3029	5233.	5932.	17433.
			36		.0076	.1930	.9221	.8134	.2768	5726.	6491.	19075.
39					.0075	.1905	.8980	.7922	.2696	5880.	6665.	19588.
	33				.00708	.1798	.8002	.7059	.2402	6598.	7480.	21980.
40		34			.0070	.1778	.7822	.6901	.2348	6750.	7652.	22486.

GAUGE NUMBERS				DIAMETER			SECTIONAL AREA			WEIGHT: Pounds per Foot		
				INCHES								
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths	Decimally	Millimeters (Decimally)	Square Inches	Circular Mils.	Log. of Square Inches	Copper	Iron and Steel	Aluminum
			37		.0068	.1727	000036317	46.24	$\bar{5}$.560108	.0001398	.0001233	.00004197
41					.0066	.1676	.000034212	43.56	534178	.0001317	.0001162	.00003954
	34				.0063	.1600	.000031173	39.69	.493772	.0001200	.0001059	.00003602
42					.0062	.1575	.000030191	38.44	.479874	.0001162	.0001025	.00003489
43			38		.0060	.1524	.000028274	36.00	.451392	.0001088	.00009602	.00003267
44					.0058	.1473	.000026421	33.64	.421946	.0001017	.00008972	.00003053
	35				.00561	.1425	.000024718	31.47	.393016	.00009515	00008394	.00002856
45					.0055	.1397	.000023758	30.25	.375816	.00009146	00008068	.00002746
46			39		.0052	.1321	.000021237	27.04	.327096	.00008175	00007212	.00002454
47	36	35			.0050	.1270	000019635	25.00	.293030	.00007559	00006668	.00002269
48			40		0048	.1219	000018096	23.04	.257572	.00006966	.00006145	.00002091
49					.0046	.1168	000016619	21.16	.220606	.00006398	.00005644	00001920
	37				.00445	.1130	000015553	19.80	.191810	.00005987	.00005282	00001797
50			41		.0044	.1118	.000015205	19.36	.181996	.00005853	.00005164	00001757
		36	42		.0040	.1016	.000012566	16.00	.099210	.00004838	00004268	00001452
	38				00396	.1006	.000012316	15.68	.090480	.00004741	00004183	.00001423
			43		.0036	.09144	000010179	12.96	.007696	.00003918	.00003457	.00001176
	39				.00353	.08966	0000097868	12.46	$\bar{6}$.990640	.00003768	.00003342	00001131
			44		.0032	.08128	0000080425	10.24	.905390	.00003096	00002731	.000009294
	40				.00314	.07976	0000077437	9.860	.888950	.00002981	.00002630	.000008949
	41		45		.00280	.07112	.0000061575	7.840	.789406	.00002370	.00002091	.000007116
	42				.00249	.06325	0000048695	6.200	.687488	.00001875	.00001654	.000005627
			46		.00240	.06096	0000045239	5.760	.655512	.00001742	00001536	000005228
	43				.00222	.05639	0000038708	4.928	.587796	.00001490	.00001315	000004473
			47		.00200	.05080	0000031416	4.000	.497150	.00001209	.00001067	000003630
	44				.00198	.05029	0000030791	3.920	.488420	.00001185	.00001046	000003558
	45				.00176	.04470	0000024329	3.098	.386116	.000009366	000008262	000002811
			48		.00160	.04064	0000020106	2.560	.303330	.000007740	000006828	000002323
	46				00157	.03988	0000019359	2.465	.286890	.000007453	.000006574	000002237
	47				.00140	.03556	.0000015394	1.960	.187346	.000005926	.000005228	000001779
	48				.00124	.03150	.0000012076	1.538	.081934	.000004649	.000004101	000001396
			49		.00120	.03048	.0000011310	1.440	.053452	.000004354	.000003841	000001307
			50		.00100	.02540	.00000078540	1.000	$\bar{7}$.895090	.000003023	000002667	0000009076
	49				.000986	.02504	.00000076356	.9722	.882844	.000002939	000002593	0000008824
	50				.000878	.02230	.00000060545	.7709	.782080	.000002331	000002056	0000006997

GAUGE NUMBERS				DIAMETER			WEIGHT: Pounds per Mile			LENGTH: Feet per Pound		
				INCHES								
American Steel & Wire Company's Steel Wire Gauge	American Wire Gauge (B. & S.)	Birmingham or Stubs	British Imperial Standard	Reduction by 64ths	Decimally	Millimeters (Decimally)	Copper	Iron and Steel	Aluminum	Copper	Iron and Steel	Aluminum
			37		.0068	.1727	.7382	.6512	.2216	7153.	8108.	23828.
41					.0066	.1676	.6954	.6134	.2087	7593.	8607.	25294.
	34				.0063	.1600	.6336	.5590	.1902	8333.	9446.	27760.
42					.0062	.1575	.6137	.5413	.1842	8604.	9753.	28663
43			38		.0060	.1524	.5747	.5070	.1725	9187.	10415.	30606.
44					.0058	.1473	.5370	.4737	.1612	9832.	11145.	32753.
	35				.00561	.1425	.5024	.4432	.1508	10509.	11913.	35009.
45					.0055	.1397	.4829	.4260	.1450	10934.	12394.	36423.
46			39		.0052	.1321	.4317	.3808	.1296	12232.	13866.	40747.
47	36	35			.0050	.1270	.3991	.3521	.1198	13230.	14997.	44072.
48			40		.0048	.1219	.3678	.3245	.1104	14355.	16273.	47821.
49					.0046	.1168	.3378	.2980	.1014	15631.	17718.	52070.
	37				.00445	.1130	.3161	.2789	.09490	16702.	18933.	55639.
50			41		.0044	.1118	.3091	.2726	.09278	17084.	19366.	56911.
		36	42		.0040	.1016	.2554	.2253	.07667	20672.	23433.	68863.
	38				.00396	.1006	.2503	.2208	.07515	21091.	23909.	70261.
			43		.0036	.09144	.2069	.1825	.06211	25520.	28929.	85015.
	39				.00353	.08966	.1989	.1755	.05971	26543.	30088.	88420.
			44		.0032	.08128	.1635	.1442	.04907	32299.	36614.	107598.
	40				.00314	.07976	.1574	.1389	.04725	33546.	38026.	111749.
	41		45		.00280	.07112	.1252	.1104	.03757	42187.	47822.	140536.
	42				.00249	.06325	.09898	.08732	.02971	53345.	60471.	177707.
			46		.00240	.06096	.09195	.08112	.02760	57421.	65091.	191285.
	43				.00222	.05639	.07868	.06941	.02362	67110.	76074.	223561.
			47		.00200	.05080	.06386	.05633	.01917	82687.	93731.	275450.
	44				.00198	.05029	.06258	.05521	.01879	84365.	95634.	281043.
	45				.00176	.04470	.04945	.04362	.01484	106775.	121036.	355694.
			48		.00160	.04064	.04087	.03605	.01227	129198.	146455.	430391.
	46				.00157	.03988	.03935	.03471	.01181	134182.	152105.	446995.
	47				.00140	.03556	.03129	.02760	.009393	168748.	191288.	562143.
	48				.00124	.03150	.02455	.02165	.007368	215105.	243837.	716570.
			49		.00120	.03048	.02299	.02028	.006901	229685.	260364.	765140.
			50		.00100	.02540	.01596	.01408	.004792	330746.	374924.	1101800.
	49				.000986	.02504	.01552	.01369	.004659	340205.	385646.	1133311.
	50				.000878	.02230	.01231	.01086	.003694	429047.	486354.	1429266.

American Steel & Wire Company's Piano and Music Wire Gauge

Diameters Shown in Decimals of an Inch

Gauge No.	American Steel & Wire Company's Steel Wire Gauge	American Steel & Wire Company's **Piano Wire Gauge**	Gauge No.	American Steel & Wire Company's Steel Wire Gauge	American Steel & Wire Company's **Piano Wire Gauge**	Gauge No.	American Steel & Wire Company's Steel Wire Gauge	American Steel & Wire Company's **Piano Wire Gauge**
6/0	.4615	.004	12	.1055	.029	29	.015	.075
5/0	.430	.005	13	.0915	.031	30	.014	.080
4/0	.3938	.006	14	.080	.033	31	.0132	.085
3/0	.3625	.007	15	.072	.035	32	.0128	.090
2/0	.331	.008	16	.0625	.037	33	.0118	.095
1/0	.3065	.009	17	.054	.039	34	.0104	.100
1	.283	.010	18	.0475	.041	35	.0095	.106
2	.2625	.011	19	.041	.043	36	.009	.112
3	.2437	.012	20	.0348	.045	37	.0085	.118
4	.225	.013	21	.03175	.047	38	.008	.124
5	.207	.014	22	.0286	.049	39	.0075	.130
6	.192	.016	23	.0258	.051	40	.007	.138
7	.177	.018	24	.023	.055	41	.0066	.146
8	.162	.020	25	.0204	.059	42	.0062	.154
9	.1483	.022	26	.0181	.063	43	.006	.162
10	.135	.024	27	.0173	.067	44	.0058	170
11	.1205	.026	28	.0162	.071	45	.0055	.180

Actual Tensile Strength of Round Wire in Pounds, Based on Various Loads per Square Inch of Cross-section

Steel Wire Gauge No.	Inches Diam.	Tensile Strength in Pounds per Square Inch						
		100,000	130,000	150,000	180,000	200,000	220,000	240,000
		Actual Tensile Strength in Pounds						
8	.1620	2061	2680	3092	3710	4122	4535	4947
½	.1651	1889	2456	2834	3401	3779	4157	4535
9	.1483	1727	2245	2591	3109	3455	3800	4145
½	.1416	1575	2047	2362	2835	3150	3465	3780
10	.1350	1431	1861	2147	2577	2863	3149	3435
½	.1277	1281	1665	1921	2305	2562	2818	3074
11	.1205	1140	1483	1711	2053	2281	2509	2737
¼	.1167	1070	1390	1604	1925	2139	2353	2567
½	.1130	1003	1304	1504	1805	2006	2206	2407
¾	.1092	937	1218	1405	1686	1873	2061	2248
12	.1055	874	1136	1311	1574	1748	1923	2098
¼	.1020	817	1062	1226	1471	1634	1798	1961
½	.0985	762	991	1143	1372	1524	1676	1829
¾	.0950	709	921	1063	1276	1418	1559	1701
13	.0915	658	855	986	1184	1315	1447	1578
¼	.0886	616	801	925	1110	1233	1356	1480
½	.0857	577	750	865	1038	1154	1269	1384
¾	.0829	540	702	810	972	1080	1188	1296
14	.0800	503	654	754	905	1005	1106	1206
¼	.0780	478	621	717	860	956	1051	1147
½	.0760	454	590	680	816	907	998	1089
¾	.0740	430	559	645	774	860	946	1032
15	.0720	407	529	611	733	814	896	977
¼	.0696	380	495	571	685	761	837	913
½	.0672	355	461	532	638	709	780	851
¾	.0649	331	430	496	595	662	728	794
16	.0625	307	399	460	552	614	675	736
¼	.0604	286	372	430	516	573	630	688
½	.0582	266	346	399	479	532	585	638
¾	.0561	247	321	371	445	494	544	593
17	.0540	229	298	343	412	458	504	550
¼	.0524	216	280	323	388	431	475	518
½	.0507	202	262	303	363	404	444	485
¾	.0491	189	246	284	341	379	417	454
18	.0475	177	230	266	319	354	390	425
¼	.0459	165	215	248	298	331	364	397
½	.0442	153	199	230	276	307	338	368
¾	.0426	143	185	214	257	285	314	342
19	.0410	132	172	198	238	264	290	317
¼	.0394	122	158	183	219	244	268	293
½	.0379	113	147	169	208	226	248	271
¾	.0363	103	135	155	186	206	228	248
20	.0348	95	124	143	171	190	209	228

To obtain actual tensile strength of wire corresponding to any required strength per square inch which exceeds that given in table: Multiply actual strength in table by the ratio between given and required strength per square inch. For example:

Required, actual strength of No. 10 wire at 260,000 lbs. per square inch. Actual strength at 100,000 lbs. per square inch (from the table, 1431 lbs

Ratio between 100,000 and 260,000=2.6. 1431x2.6=3721=required actual strength at 260,000 lbs. per square inch.

When required strength per square inch is less than that given in table; use ratio as before, but *divide* instead of *multiplying*.

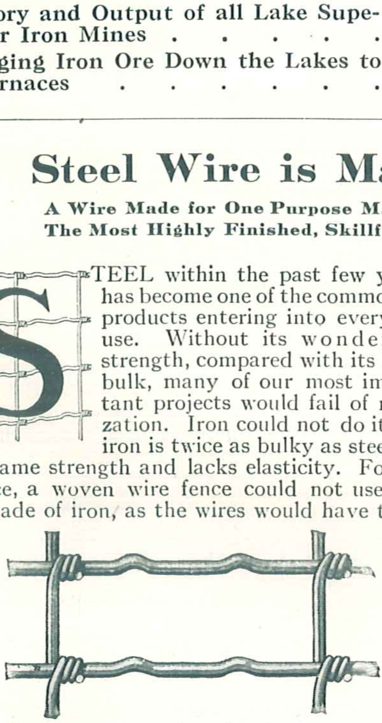
Making Steel and Wire

INDEX

Steel Wire is Made in Many Varieties

A Wire Made for One Purpose May Not Economically Be Adapted to Another. The Most Highly Finished, Skillful and Costly Product of the Steelmaker's Art.

STEEL within the past few years has become one of the commonest products entering into everyday use. Without its wonderful strength, compared with its light bulk, many of our most important projects would fail of realization. Iron could not do it, for iron is twice as bulky as steel for the same strength and lacks elasticity. For instance, a woven wire fence could not usefully be made of iron, as the wires would have to be

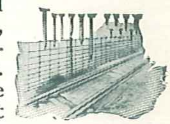


Tension curves or crimps in a fence to give elasticity, enabling the fence to be tightly stretched and hold its shape. Also to provide against expansion and contraction of heat and cold.

too big, hence twice as heavy for the same strength and twice as expensive, and again, the tension curves or crimps in the fence would be useless in such a non-elastic metal as iron.

A woven wire fence made of iron could not be tightly stretched upon the posts. It would hang limp and shapeless, without the requisites of expansion and contraction for heat and cold.

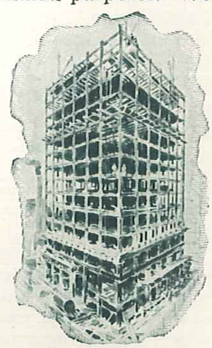
It is not long since steel has almost entirely superseded iron where high tensile strength and low weight are necessary. So comparatively new is it in the more common uses that some people accustomed for many years to iron, have not become thoroughly acquainted with the advantages of steel nor its processes of manufacture. The principal output used to be iron, and when the superiority of steel absolutely became apparent, men were sent all over the country to instruct people about it. Bureaus were maintained for the purpose of ascertaining what new uses steel could be put to, with the success everybody is familiar with.



American wire nails and tacks. American fence and steel rails.

Of course since earlier times there has been fine steel made in the crucible by slow and very expensive methods. This rare metal was used in swords and fine tools, but the immense utility of modern cheap steel for all the commoner uses was not ours until within a comparatively short period.

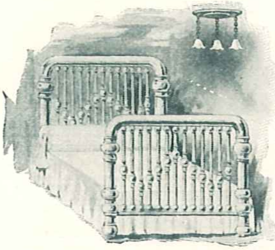
This great era opened with practically only one kind of steel for all common purposes. We had not yet learned to make it apply to the many hundreds of special uses all the way from our wire nails or tacks, steel springs, piano wire or wire rope to a woven wire fence. Within the past ten years this infinite division of the special qualities of steel has been made. Steel is from the one common stock and owes its great variation and adaptation to different uses to its subsequent treatment. We make steel flat wire that is plated with nickel and made into alarm clock cases, or is plated with brass and made into electroliers and brass beds.



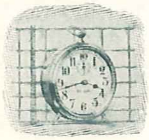
A Skyscraper, made possible by modern steel, same quality as used in American fence.

This is a very soft and ductile steel, easily

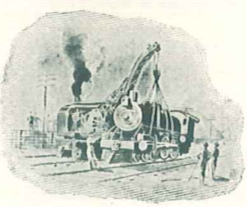
worked into such shapes and is practically of the same workable quality as expensive brass and copper; and when brass or copper plated, presents the same appearance, performs the same function and is a stronger metal.


The Electrolier and the Bed.

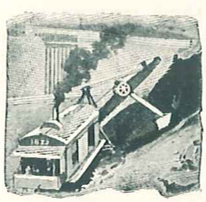
We make steel wire of tremendous strength in addition to pliability such as for our American wire rope, from a slender thread of which is suspended thousands of tons and which is used in the machines that have dug the Panama Canal and will operate it. This steel has to be soft and pliable like silk and yet of immense tensile strength.



Against this we contrast our corset steel which is very thin, springy and tough, and is used for stiffening corsets in place of the old whalebone. Then consider the superfine steel in our American piano wire that is used in most of the pianos in this country, of which there are made and sold annually about 350,000. The wires of a modern grand piano make a total strain of over 20 tons and rarely break, yielding a perfect musical tone. Our wire put in pianos over fifty years ago is still as good as new.

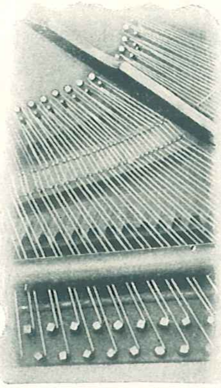

Hoisting a Locomotive with American wire rope.

Contrast this kind of steel with our W. & M. telephone and telegraph wire. This steel is made in such a special way that it affords great electrical conductivity and at the same time is strong enough to be suspended in long lengths from high poles, swinging to the storm and burdened with heavy sleet.

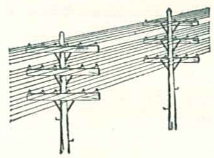

On the Panama Canal.

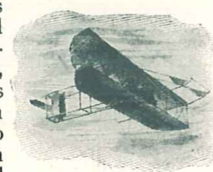
Then there is that most modern steel wire that has made the aeroplane possible and which we especially designed for the Wright Brothers — a steel of great compactness and yet strong enough to hold the planes together under the strain of aerial flights. Compare this with the superb engineering of the modern concrete structure, or the concrete paved roadway, both of which contain a reinforcement of our wire fabric embedded in the concrete, to which is thus imparted the strength of the steel. The wire reinforced concrete highway is the form of road that will amply sustain tremendous usage of modern travel, and while costing more at first, yet within a few years will more than compensate, because of greater durability.

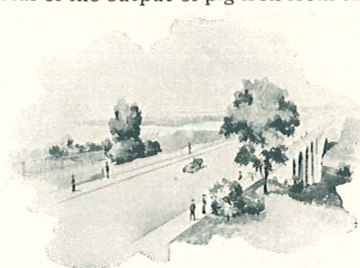
And then we have barbed wire — our plain, everyday barbed wire that everybody and every animal has known and respected for generations. And finally, as triumph of wire engineering, the wire that we put into our woven wire fence.


American piano wire put in this piano 54 years ago.

Who can say that having passed through the entire range of the uses of steel wire, we are not prepared to judge what is best adapted for all these different uses, and to make that steel which is best for each peculiar use and to make it in greater quantities and at a cheaper cost? Steel, to be well and cheaply made, must be made in tremendous quantities—on a scale of magnitude in the United States that has staggered the whole world and is fairly incomprehensible even to our own people. In 1913 there was dug from the great Lake Superior mines and shipped by steamers down the lakes, about 50,000,000 tons of iron ore, and this was melted into over 25,000,000 tons of pig iron — 2 tons of ore for 1 ton of pig iron. To melt this ore into pig iron takes 38,500,000 tons of coal (made into coke) and 6,096,000 tons of limestone, a total of 94,596,000 tons lifted out of the earth in rough form in one year to be put on top of the earth in the shape of wonderful moving and majestic appearing things, constituting the mighty steel backbone of our unparalleled civilization. And this total of the output of pig iron from the Lake Superior ore, added to the 10,000,000 tons of pig iron made from the ore of all the other iron mines in the United States, represents a huge stream of molten metal, flowing continuously day and night.


W. & M. Telephone Wire.

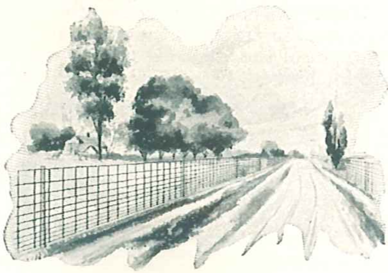

American Aeroplane Wire.


A concrete roadway and bridge, reinforced with triangle mesh wire reinforcement.

This is why the United States is ahead of the whole world in the making of steel and has been so for 20 years. It is this tremendous quantity — this big "business" so to speak — that engages the exclusive attention of approximately 1,000,000 men.

An Ore Boat.

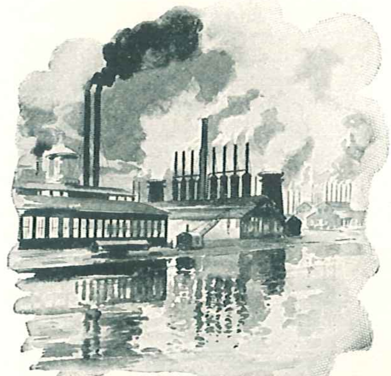
Fires cool, and what is done cheaply and to the best advantage must be done quickly. The most must be accomplished while the iron is hot. There must be the least number of heatings over again — this is one of the secrets of cheap steelmaking. And the highest attainable practice is to get the metal nearest the finished form for commercial use on what is called the "initial heat;" further, to get it on the cars and en route to the consumer, and it is not uncommon to see



American Fence.

carloads of certain finished forms 100 miles away from the mill and the metal still warm.

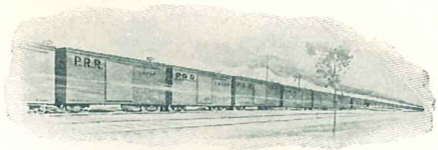
With an industry so comparatively new — at least in the extent and variety of usage — what is more natural than that there should be considerable misunderstanding as to how steel is made, relatively simple though the process may



The Birthplace of American Wire.

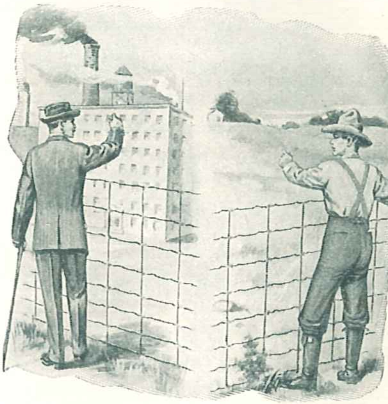
be. Every business has its technical expressions which are simple enough to those engaged in the business, but to the other fellow they are more or less mysterious.

Nothing is more complicated in its technique than scientific farming. No profession of en-



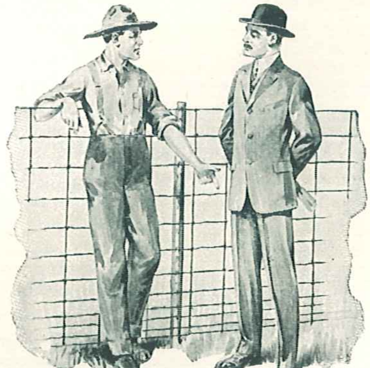
100 miles away and still warm.

gineering or of any of the sciences for that matter, is more complex or calls for higher training. The expert steelmaker would not ordinarily fully grasp the meaning of such expressions as "soil inoculation," "nutritive ratio,"



A scientific manufacturer and a scientific farmer — neither understands the other's talk.

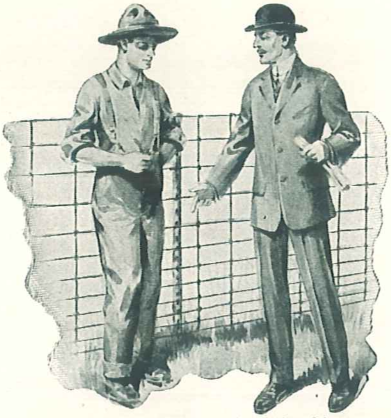
"Babcock test," "green manuring," "Mendelian law," "pickling grain," "nitrifying bacteria," and the farmer might easily mystify him. On the other hand a farmer is led away by the different expressions of steel salesmen who glibly use such terms as "basic open hearth," "acid



The farmer is telling his side of it.

open hearth," "bessemer steel," "hot shortness," "cold shortness," "critical temperature," "lead annealing," all of which are correct in their place but in the hands of salesmen who may not

know or else are willfully trying to misrepresent the situation, are very apt to carry a serious misunderstanding to which no buyer of steel prod-



The salesman is telling his side of it.

ucts can afford to be a party. And so we have prepared the following simple story of the making of steel, plainly setting forth the actual facts and enabling the reader better to understand what this metal really is, where it comes from, how it is made, and how it is drawn into wire. Steel has its limitations according to the use to which it is put — steel for one purpose may not be desirable for another. The man who wants wire for a fence is not willing to pay for piano wire nor should he, because a costly piano wire at over 50 cents a pound would not be so well adapted for a woven wire fence as the steel we already put in our fences.

Fence Wire, Piano Wire.

Therefore, if a salesman should include in the story of his goods, descriptions of the more costly processes of making rare steel that is adapted for high duty purposes, and would seek by inference or otherwise to convey the impression that such costly processes were embodied in his fence, the reader may, with the assistance of the following pages, be enabled to judge for himself.

Mining Iron Ore in World's Greatest District

Largest and Best Deposits Are in the Lake Superior Region—Relative Value Not So Much Due to Iron Content as the Cost of Separation from Different Elements—Good Bessemer Ore is Highest Grade Because it Has Little Phosphorus in it

IRON is the principal metal of this world, as it exists in greater quantity than any other metal. It abounds in practically all rocks and earths and most any farm well-water may show its red and rusty deposit at the pump's spout.

Ages ago, subterranean torrents of water, rushing through underground passages, washed out of the various kinds of rocks and soils and chemically compounded this rusty deposit and accumulated it into great beds and pockets along or near the surface of the earth and also hundreds of feet underground.

Not all of this deposit is commercially available, as it is often so combined with other substances as to make it either impossible or else very expensive to melt into iron by any methods so far devised by man.

The most favorable deposits, therefore, have been the ones so far used and at the present time the iron mines of Lake Superior are not only the greatest in extent of any on earth and the richest in iron, but less burdened with the other elements that always go with iron ore, such as phosphorus, silicon, sulphur, manganese, aluminum, lime, magnesia, arsenic, titanium, and are therefore most readily and cheaply melted in the blast furnace, and later made into good steel.

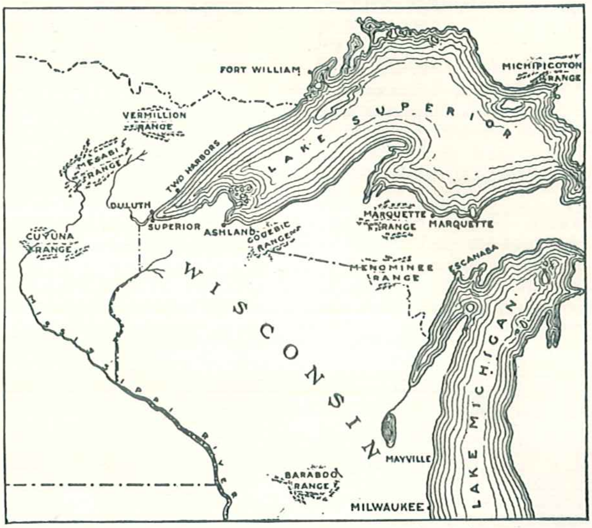
The first iron ore shipped from Lake Superior was worth $10.00 a ton. It is now worth about $5.00 a ton, with variations for quality, which makes the price slightly lower than hard coal.

The relative value of iron ore is not so much according to the iron it contains as the cost of separating it from the different elements. Being practically "iron rust mixed with dirt," it is therefore the different varieties of "dirt" that reduces its value. Lime and magnesia to a certain extent are good, because limestone has to be put into the blast furnace with the ore, anyhow. Aluminum is not so desirable. A little manganese does no harm. The less sulphur the better. Phosphorus is highly undesirable, and this one element causes the separation of the ore business into two distinct divisions — bessemer ore and non-bessemer ore.

Good bessemer ore is the highest grade of ore because it has little phosphorus in it and it is made into bessemer steel in the bessemer furnace. Non-bessemer ore is what is left and has considerable phosphorus. Good bessemer ore is mixed with it to reduce the average of phosphorus. This kind of ore is made into steel in the open hearth furnace.

Although there are many variations, the following table will give an idea of the analyses of the two kinds:

	Iron	Phosphorus	Silicon	Manganese	Alumina
Good bessemer ore.......	60.	.035	5.00	.15	2.5
Medium bessemer ore....	50.	.05	10.00	.02	3.0
Good non-bessemer ore...	55.	.10	18.00	.35	2.5
Medium non-bessemer ore.	50.	.40	18.00	.35	2.5



Map showing location of Lake Superior iron mines.

If only ore from mines having the highest percentage of iron and the lowest percentage of phosphorus was used, it would be exhausted in a very few years. In earlier days when steel was not used to such a vast extent as today, only such ore was actually used and those mines no longer yield.

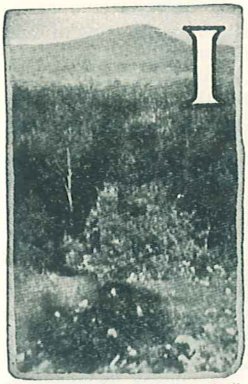
Other mines equally rich have since been discovered, but with the increasing demands for steel, which is now about 35,000,000 tons a year in the United States, and the ever increasing variety of steels made to suit every kind of use, all the way from our horseshoes to our piano wire, the widest range of selection of ores is absolutely necessary, and ores of varying chemical qualities are mixed to make up a fair average for the variety of iron wanted.

Thus the making of the character of the iron begins with the mixture of the ores from the different mines into groups, almost every mine contributing a distinct characteristic feature — different parts of the same mine sometimes yielding ore of quite different analysis.

These groups are loaded into ore cars and thence dumped into ore steamers for shipment to furnaces at Chicago, Gary, Cleveland, Pittsburgh or other points, and the furnaces advised by wire of the chemical analysis. Sometimes two groups of ore are shipped in one steamer, carefully separated. The furnace takes another analysis to be sure the ore is as represented.

History and Output of all Lake Superior Iron Mines

Iron Mines

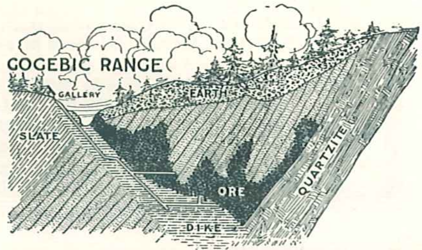


This top surface is stripped off.

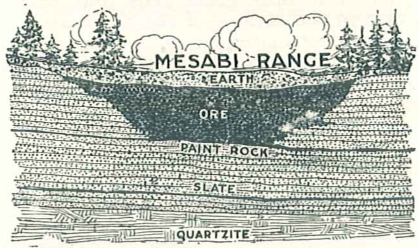
IRON mines are either underground, with deep shafts and connecting galleries from which the ore is hoisted in buckets with wire rope, or in some cases the ore lies close to the top of the ground and is scooped by steam shovels directly into waiting cars, making the cheapest form of mining. But it is impossible to get this cheapness without first expending enormous sums of money in stripping off the top layer of twenty-five or fifty feet of earth over a vast section of country.

The location of the great Lake Superior iron ranges is shown by map on preceding page, and they yield ore fairly described and classified under three great characteristic divisions as follows:

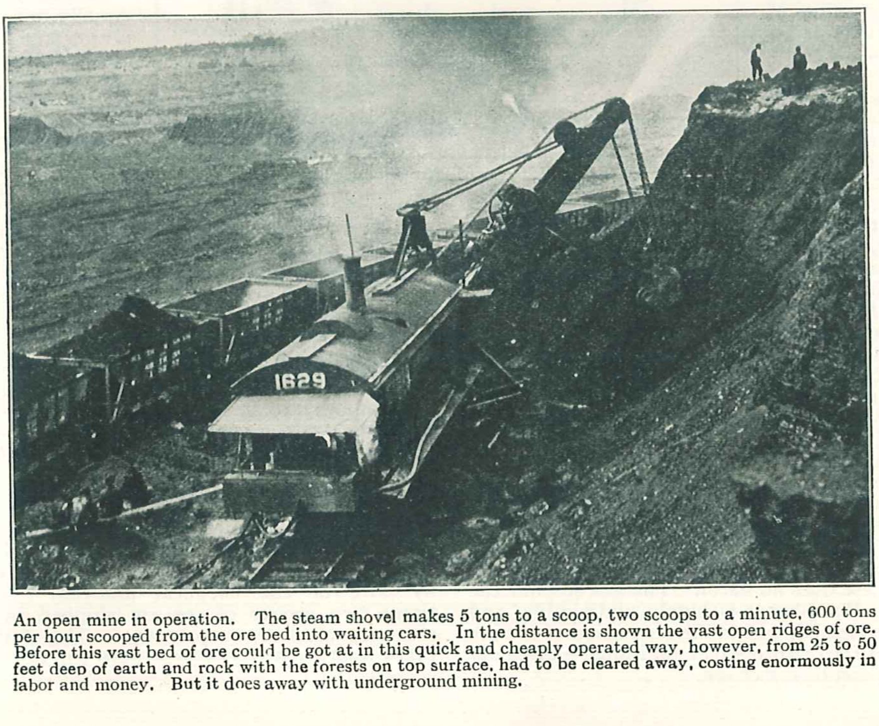
Magnetite ore. Contains 72.4% iron. Steel gray color. Has the highest percentage of iron and may be picked up with a magnet. Is the same composition as the scale that forms on a bar of iron after a blacksmith has heated it red hot in his forge.



Hematite ore. Contains 70% iron. Deep red color. Identical in composition with the common red rust that forms on any piece of iron or steel.



Limonite ore. Contains 59.8% of iron. Yellow in color. Is the same as hematite except it is heavily impregnated with water in combination (called "hydrated") which can only be eliminated under high temperature. A familiar form of limonite is the fresh yellow color of newly rusted iron before it later turns to deep red.

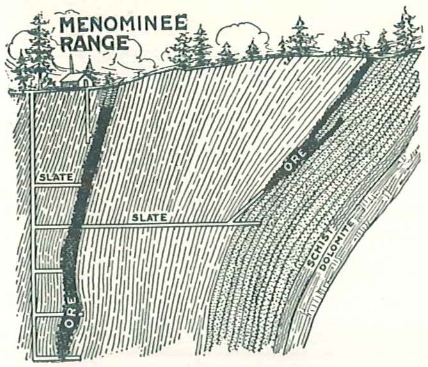


An open mine in operation. The steam shovel makes 5 tons to a scoop, two scoops to a minute, 600 tons per hour scooped from the ore bed into waiting cars. In the distance is shown the vast open ridges of ore. Before this vast bed of ore could be got at in this quick and cheaply operated way, however, from 25 to 50 feet deep of earth and rock with the forests on top surface, had to be cleared away, costing enormously in labor and money. But it does away with underground mining.

About one hundred and fifteen mines. First ore dug in 1892. The largest shipper of ore of any of the ranges. Extends about one hundred miles east and west. Hydrated hematite with some limonite, varying in texture from very fine dust to fairly coarse, hard and granular ore. Shallow deposits. Has produced 279,067,325 tons, the principal producers being:

Name	Tons	Name	Tons
Adams........	15,248,914	Lectonia......	3,599,256
Albany........	2,375,860	Lincoln.......	2,845,700
Burt..........	11,284,023	Mahoning.....	16,577,443
Chisholm......	3,998,872	Morris........	8,721,958
Clark.........	4,473,364	Sellers........	3,912,207
Commodore....	3,415,044	Shenango......	4,806,796
Fayal.........	20,520,032	Spruce........	7,159,127
Genoa........	5,507,903	Stevenson.....	12,120,107
Glen..........	2,316,973	Virginia.......	10,478,668
Hull-Rust.....	20,958,235		

About twenty mines. First ore in 1883. Soft red and partially hydrated hematite with subordinate amounts hard blue hematite. Illustration shows vertical section. The deepest



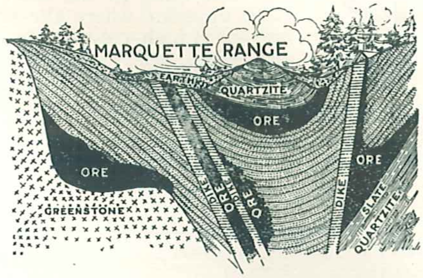
mines are: the Newport, 2,200 ft.; Montreal, 1,900 ft.; Yale, 1,780 ft.; Norrie-Aurora, 1,670 ft.; Ashland, 1,324 ft. Has produced 72,745,401 tons, the principal producers being:

Name	Tons	Name	Tons
Ashland.......	5,981,795	Montreal......	3,392,704
Atlantic.......	1,769,050	Newport	8,561,514
Brotherton....	2,069,069	Norrie-Aurora..	27,770,572
Cary..........	3,174,130	Sunday Lake...	1,634,042
Colby.........	2,931,926	Tilden........	5,485,110

Fifty mines. First ore in 1873. Iron deposit differs distinctly from other ranges in that the ore is in narrow belts. Ores are mostly gray hematite. Illustration shows vertical section. The deepest mines are: Chapin, 1,522 ft.; East Vulcan, 1,400 ft. Has produced 84,073,407 tons, the principal producing mines being:

Name	Tons	Name	Tons
Antoine.......	1,622,637	Great Western.	2,040,618
Aragon........	6,523,408	Hemlock......	1,939,109
Baltic.........	1,507,831	Loretto.......	1,465,768
Bristol........	3,214,375	Mansfield.....	1,272,001
Chapin.......	18 334,646	Pewabic......	7,949,542
Crystal Falls...	1,736,626	Riverton......	2,571,231
Dunn.........	2.132,412	Tobin.........	2,258,324
Florence.......	3,152,128		

Forty mines. Illustration shows vertical section. The deepest mines are: Champion, 2,292 ft.; Republic, 1,950 ft.; Hartford, 1,075 ft. First ore dug and first iron ore made in Lake Superior region, 5 miles from Negaunee, Mich., in 1848. Furnace operated several years, largest output being 3 tons in one day. Ores are mostly soft hematite with subordinate amounts of magne-



tite and limonite. Has produced 103,332,141 tons, the principal producing mines running back for a long period of years being:

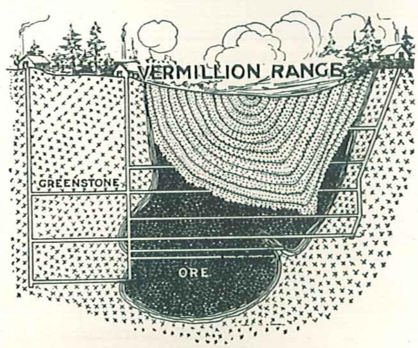
Name	Tons	Name	Tons
Angeline......	8,846,002	Jackson.......	4,028,314
Cambria......	2,348,369	Queen Group..	6,872,131
Champion.....	4,413,131	Lake Sup......	15,627,640
Cliff Shaft.....	23,754.904	Princeton......	1,551,302
Hartford......	1,950,422	Republic......	6,614,079

About seven mines. First ore in 1883. Hard blue and red hematite. The deepest mines are Pioneer, 1,261 ft.; Soudan, 1,249 ft.; Zenith, 1,100 ft. Has produced 33,262,473 tons, the principal producers being:

Name	Tons	Name	Tons
Chandler......	9,660,954	Soudan........	8,511,426
Pioneer.......	8,565,888	Zenith........	2,812,969
Savoy.........	1,597,978	Sec. 30 (new)...	243,292
Sibley.........	1,869,936		

Baraboo Range

One mine, the Illinois. First ore 1904. Soft red bessemer hematite. Underground mine to depth of 485 feet.



Mayville Range

Two mines. First ore 1848. Iron Range mine underground and Mayville mine open pit. Both non-bessemer hematite.

Cuyuna Range

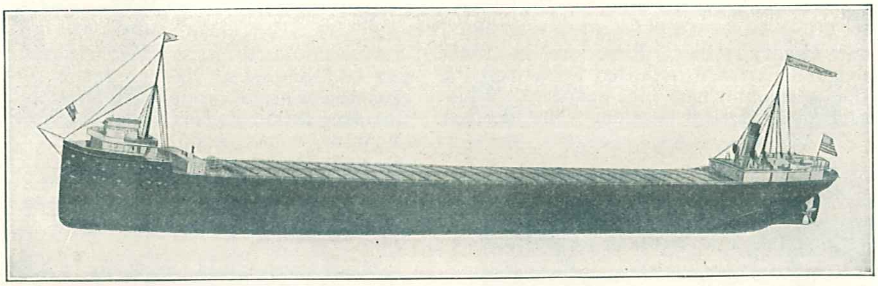
Has just ended its third season. Extensive explorations under way in this new and promising range.

Bringing Iron Ore Down the Lakes to Furnaces

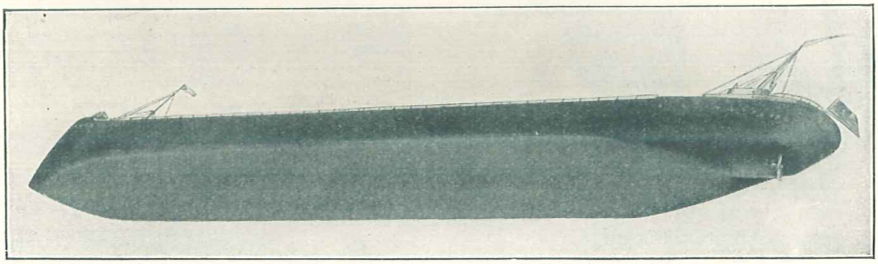
RAILWAY CARS, carrying 50 tons of ore each, are run in trains from the mine to the shore of Lake Superior where the train mounts a high trestle over the shipping wharves and the ore is dumped into bins holding 5 to 8 carloads each, and from these bins in turn the ore is dumped directly into the hold of the monster ore vessel. Only two and one half hours' time is required to load these great carriers. Fifty million tons of ore was thus brought down from the mines in 1913.

Leaving Duluth or Two Harbors with about 12,000 tons of ore, the ship steams through the Soo Canal and lays its course for Chicago, Gary, Cleveland, Conneaut, O., or other points of destination. From Conneaut, for instance, the ore is loaded into railway cars and transported to Pittsburgh, two and one half hours distant.

Unloading the ore cargo has kept pace with the loading, about 2½ hours to load and an equally short time to unload.



Ore carrying vessels are made as big as the Soo Canal locks will permit. The locks are 61 ft. wide, the vessel 60 ft. The door sill of the lock is 19 ft. 1 inch and the large boats draw 19 ft. 2 inches. Starting the vessel's propeller forces another inch of water into the lock and in floats the boat. Close figuring.



THE WILLIAM P. PALMER

Naval architects have built ore vessels with peculiarly shaped bottoms, as shown in the picture, the idea being to carry the greatest quantity of ore possible at the least draft. Flat bottomed and efficient, carrying 12,000 tons of ore.

The Ore Steamship, William P. Palmer, one of the latest examples of these vessels. Length, 580 ft., Width 58 ft.; Ore Capacity, 12,000 tons.

The Blast Furnace

Employing Fire to Create Steel—Fire may Also Destroy, as Steel Can Be Burned

THE BLAST FURNACE IS pretty much like an old-fashioned base-burner coal stove. It is fed fuel at the top and air at the bottom, with the fiercest fire in the fire pot at the base, just the same. At times both burn dull and cold, form the same clinkers, and as the coal in the top of a base-burner slips down after a clogging clinker gives way, so does the load of a blast furnace; it is only a difference in size and weight, the base-burner's load being two buckets of coal while the blast furnace's load is about 1,300 tons.

The base-burner sometimes emits gas enough to asphyxiate a family, the blast furnace emits enough through the downcomer to run a battery of steam boilers and gas engines, and to heat the red-hot air blast that feeds it. Blast furnace gas is so poisonous that 0.70 per cent breathed with air produces unconsciousness, while one per cent is very dangerous to life. The top of a base-burner is held down with a tight lid, and so is the top of a blast furnace to hold the gas in and only allow it to escape through the down-comer, and as the base-burner sometimes has little explosions that lift the lid, the blast furnace blows its top off and vomits tons of contents high in air like a bottle of pop shooting its cork.

It is a job to start even the simple domestic base-burner, but it takes about two weeks to get a blast furnace going.

The two are as alike as a cat and a tiger, only the tiger is more so.

The problem is to melt iron ore into commercial iron. This is done by filling in through the top of the furnace, alternate layers of ore, limestone and coke. The proportions of these three vary according as the ore may contain varying proportions of phosphorus, silicon, sulphur, manganese, alumina or other miscellaneous ingredients that are in the ore when it is dug out of the ground. Unless this mixture is most carefully weighed, balanced and tested by chemical analysis of each part, just as we balance the food that goes into the stomach, there is terrible trouble.

For instance, a certain ore is melting just right when it becomes necessary to change to another ore that is thought to be exactly like it, but later on proves to have a little less alumina. Furthermore, the new ore and limestone are wet. The chemical result is the mass refuses to melt readily and it costs several thousand dollars to "physic" the furnace.

A blast furnace of the standard height of 90 feet will take every 24 hours 800 tons of ore, 400 tons of coke and 100 tons of limestone. Through this mass is passed 2,500 tons of air which furnishes the needed oxygen. From this load of materials about 400 tons of pig iron is produced.

Limestone is put in the furnace to "draw" the silicon, sulphur, manganese, alumina and other ingredients except phosphorus, out of the melting iron, and it does this and there is formed a frothy substance (which includes ashes of the coke and all miscellaneous products of combustion that do not go out of the top with the gas), that floats on top of the molten mass like cream on the surface of milk, and this mass is called slag. The slag is drawn off in a separate stream through the cinder notch, leaving the clean iron to be drawn off through the lower or iron notch. If the sulphur in the ore is plentiful, more limestone and fuel will take it out of the iron.

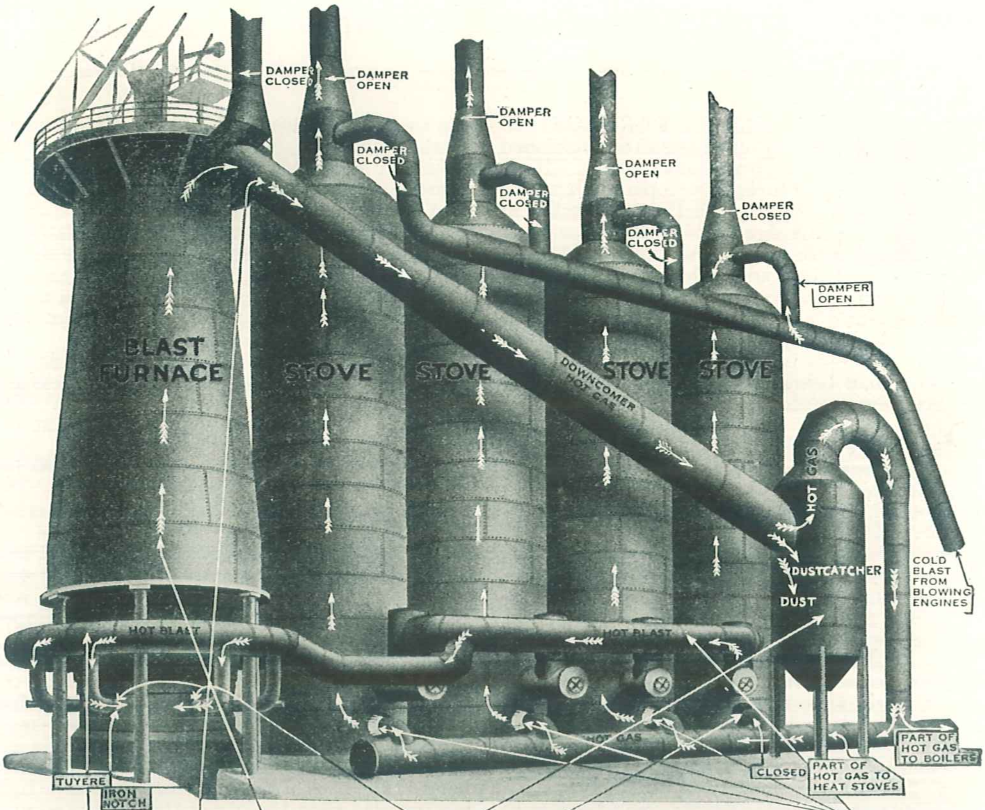
Nearly all of the phosphorus, considerable sulphur, about three-quarters of manganese and more or less silicon, remain in the iron. The alumina, lime and other ingredients of the ore form the slag.

Coke is used to melt the ore in over 90 per cent of blast furnaces in the United States. The balance of the furnaces use charcoal or anthracite coal. Coke is made by baking bituminous coal for 48 hours in closed ovens, a ton of coal producing two-thirds of a ton of coke. The coal from near Pittsburgh and south to Virginia and Kentucky is almost the only kind yet developed that will make into furnace coke.

The fibrous structure of the coke must be strong enough to sustain without crushing, the terrific burden of 1,300 tons of load in the furnace; must be porous to let the blast pass freely through it, and must burn with very little ash and be very pure. Looking through the peepholes in the base of the furnace, the coke — having traveled from the top of the furnace — may be seen dropping down as chunks of fire past the level where the blast enters, although the temperature at this level is over 3,500 degrees F.

Coke consists mostly of carbon (88%), and the burning coke, together with the red-hot blast, produces the above intense heat, which completes the final process of melting the iron and the slag, imparting to the pig iron about 3½% to 4% of carbon.

Carbon is the most important ingredient of iron and steel. Without carbon, iron would have little strength, hence it is an absolutely essential element in iron. Iron can absorb 4.7 per cent of carbon. The other elements that have remained in the iron from the ore, such as silicon, sulphur, manganese and phosphorus, at once yield precedence to carbon, and their influence thereafter is only as they act in combination to change the condition of the carbon. As an instance, three per cent of silicon promotes soundness, softness and strength, and decreases shrinkage and chilling properties by changing the carbon under a metallurgical law. Manganese, next to carbon, is the most important. It works upon carbon in certain percentages to counteract the hardening effect of sulphur and is beneficial to iron not having much silicon, as it keeps the sulphur low. It also enables the iron to hold more carbon. Phosphorus has a strong, excluding effect upon carbon and makes iron more fluid so it will flow into intricate patterns in molding.



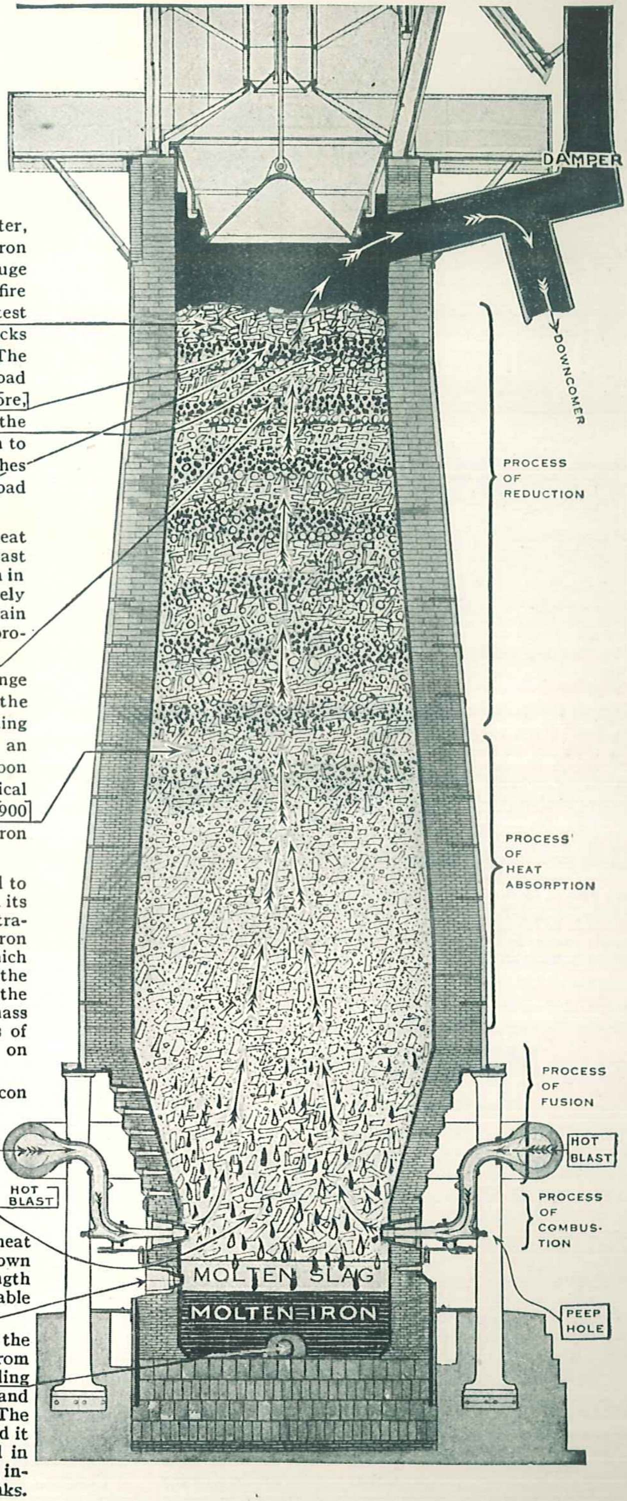
ONE FURNACE AND FOUR STOVES TO HEAT THE BLAST—Four stoves accompany each furnace. They are lined with fire brick and heated red hot. Only one stove at a time is used to make hot blast for the furnace. 40,000 to 60,000 cubic feet of cold blast per minute from blowing engines enter the one hot stove while the other three are being heated. The cold blast is shifted to a fresh hot stove every 15 minutes. Heated to 1,400 degrees F., the blast passes through the hot blast main to the bustle pipe around furnace; thence down waterjacketed tuyeres into the furnace at the hottest point, 3,500 degrees F. The blast pressure is usually 10 pounds per square inch. This hot blast furnishes about one-fifth of total heat of the furnace. Before the blast is heated it is refrigerated to take out moisture; heating and refrigerating increasing the efficiency over old-fashioned cold blast 70 per cent. The blast passing up through the furnace, becomes heavily impregnated with gas and rushes out through the downcomer. This gas is loaded with coke dust and other particles swept up while passing through the furnace, that are dropped in dustcatcher, from whence the gas passes upward and downward through the hot gas main in a red hot gush of fire into three of the stoves and out through the tall chimneys. A furnace makes more gas than necessary to heat its stoves, so some of it is diverted to boilers, making steam for blowing engines, or is further cleaned and used to run gas engines for blowing.

This is but a bare outline of iron making. It would take a big book to go into the details of this, the greatest and most influential of the commercial arts which, though existing for ages, is still only on its way toward perfection and which to the average citizen is shrouded in mystery.

The iron and steel industry in the United States is limited to the supply of coke which comes from near Pittsburgh. The dream of inventors is to make the soft coal of Indiana and Illinois into steel-making coke — as yet only a dream — and thus bring the making of iron nearer the ore fields. Science yet will solve it.

The blast furnace produces pig iron. The pig iron that is destined to be made into stoves is not the same pig iron that is eventually going into steel for woven wire fence nor for piano wires. The regular market varieties are numerous and each commands a different price as will be seen by the quotations in the trade journals.

The blast furnace, and therefore the beginning of steel making, is limited in the quality of its production by the variety of the ores with which it may be fed. Hence, companies owning and commanding the widest range of ore deposits have the enormous advantage of the most extreme variety of selection, which gives them ready command over the qualities of their steels.



STANDARD height, 90 feet; diameter, about 25 feet. Makes 400 tons of iron every 24 hours. Built of steel like huge upright steam boiler and lined with fire brick, the lower portion which is hottest being surrounded with hollow bronze bricks filled with rapidly flowing water. The blast passes up through 1,300 tons of load which is arranged in alternate layers of ore, coke and limestone, skilfully put in at the top so as to be loose and porous enough to allow free passage of the blast which rushes up about as fast in one second as the load melts and sinks in one hour.

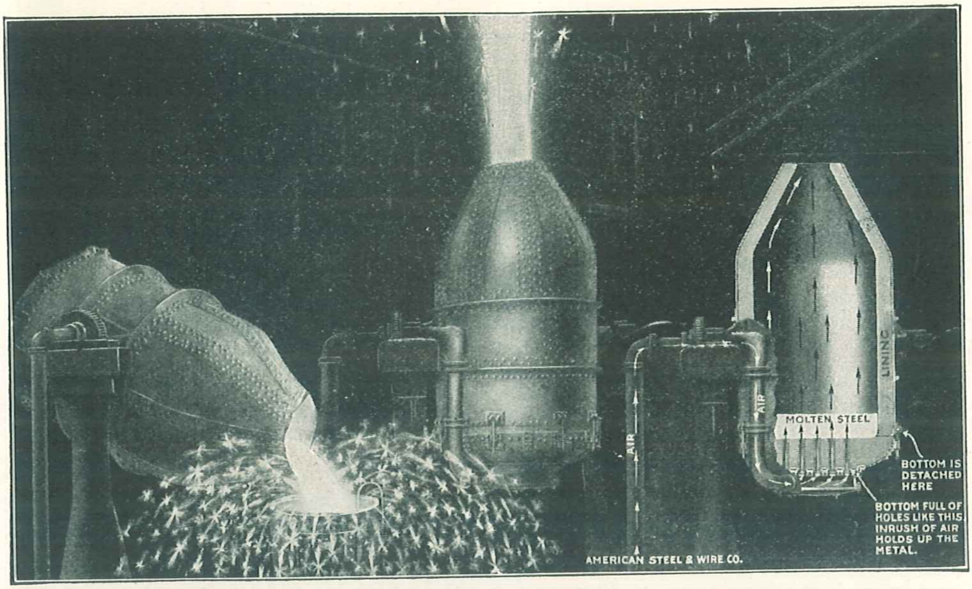
As the load sinks to 400 degrees of heat the chemical action of the uprushing blast of gas removes 90 per cent of the oxygen in the ore and transforms the ore into a finely divided sponge of iron particles that remain in this shape all the way down to the process of fusion.

Sinking to 430 degrees of heat, the sponge begins to take on great quantities of the glowing carbon from the coke, amounting to several times its own volume, but an opposing chemical action sweeps the carbon away; again it returns. This chemical battle keeps up until the load sinks to 900 degrees of heat, when the carbon in the iron sponge ceases to increase.

From the 900 degrees point downward to the process of fusion the iron sponge with its dissolved carbon passes, and the illustration shows it melting into drops of iron together with the drops of slag—which is the union of the siliceous residue of the ore and limestone and the ashes of the coke—all trickling down through the mass of incandescent coke at 3,500 degrees of heat. The slag floats on top, the iron on the bottom.

The iron has absorbed carbon and silicon in comparatively large quantities; and later, when this iron is being made into steel in the bessemer converter (as described in succeeding pages) it is the burning of this carbon and other elements, combined with the oxygen of the air that is blown through the converter, that produces the great heat and the sparks of burning steel as shown on page 78. Carbon is the life, strength and resiliency of steel, but it is inflammable and readily burns.

The slag is drawn off frequently at the cinder notch, while the iron is drawn from the iron notch every four hours, yielding about 70 tons of pig iron at a draw and taking about 30 minutes to run out. The blast is stopped to replug the notch and it is then that the whole mass of material in the furnace, relieved of the supporting influence of the upward blast, slightly sinks.



BESSEMER PROCESS OF STEEL MAKING—A steel vessel about 12 ft. diameter by 20 ft. high, called a converter, is tipped on its side and molten pig iron is poured into its mouth. Turned upright, a blast of air at a pressure of about 20 pounds per square inch, is turned on at the rate of 20,000 cu. ft. per minute. The molten pig iron covers the bottom to the height of 18 inches. The bottom is full of holes to admit air which, at above pressure, holds up the metal and prevents it from dropping down and filling the holes. The lining of the converter is 1 foot thick, of highly refractory material. It takes from 9 to 15 minutes to turn the molten pig iron into steel.

The illustration shows 3 views of a bessemer converter. The one on the right shows the inside of a converter and how the air is blown through the bottom. The middle view shows converter in action throwing sparks of burning steel particles into the air. View on left shows converter discharging the finished steel.

The wire drawing properties of low carbon bessemer steel are always equal to and in most cases superior to basic open hearth steel of like composition. When given the same care in manufacture and treatment, the internal and surface imperfections are no greater in one than in the other. The physical characterization of low carbon bessemer are quite favorable to its use for many of the most important wire products, particularly such as nails, fence, barbed wire, etc. Is usually higher in tensile strength, lower in elongation and reduction of area and is somewhat more rigid than open hearth steel of similar analysis.

Making Steel

The Bessemer Process

Bessemer process—blowing air up through vessel from bottom.

FIRE purifies; fire destroys. A good servant, a hard master. Fire found man living in a cave in the earth and placed him in the palace.

Fire carved each step of world culture, and by its use the race will continue rising.

What is fire? Something invisible in the air which coming in contact with substances produces heat, or heat and light. The air is drawn into our lungs, a part unites with the animal matter of the body, and outside the feeling of warmth there is no outward manifestation.

The action of the air on substances to produce heat, or heat with light, is called burning.

Science has shown that light, burning, is the outward manifestation of the oxygen of the air (the invisible element) uniting with matter.

To burn, to produce heat and light, calls for the starting spark. Maybe the flash of lightning was the first spark or the rubbing of trees as they swayed in the wind. Whatever it was, it has been treasured from gray antiquity to the present.

Another step. Iron burns, steel burns, the diamond burns, most of the metals we know burn, that is, unite with oxygen.

Alarmed, we ask — will everything burn?

To fire is due the production of metallic iron; to controlled directed fire, the product of the wonderful substance called steel.

Limited resources of craft and capital can produce iron; only expert craftsmanship, with unlim-

OPEN HEARTH PROCESS OF STEEL MAKING. The molten steel lies about 18 inches deep upon a bed about 40 feet long by 16 feet wide. The lining of this bed consists of magnesite, dolomite and lime. The walls and roof are constructed of silica bricks. The illustration shows the current of hot gas and air being forced above and around the molten metal and passing out through the "checkers" at the left, thence out to the chimney. The "checkers" represent the walls of regenerative chambers, that catch and preserve the heat. The damper at bottom is then turned over to the left, and the current is reversed so the heat stored up in the "checkers" is imparted to it.

Ore of less purity than that used in the bessemer process is successfully made into fine steel by the open hearth process.

ited facilities of forge and capital can produce steel.

Steel is made from pig iron by burning out and slagging out elements which adulterate. These elements may be catalogued. .Silicon, a constituent of sand, dirt, rocks; alumina, a constituent of clay, burned brick; phosphorus, the element used on the common phosphorus match; sulphur or brimstone, the element of "sulphur and molasses"; and manganese.

In 1856 the startling statement was delivered to the world: "Steel can be made without the use of fuel!" This sounded like making bricks without straw.

Henry Bessemer made steel by blowing air into molten pig iron and confounded the wisest ironmasters of the time. Simple enough — the oxygen of the air blown into the molten pig burns the silicon in the pig and produces great heat; burns the manganese and carbon and produces more heat. These elements burn out and leave the steel.

There results an unadulterated iron, you might say a characterless metal, which can be combined with carbon and manganese to make all kinds of steel. For example — razor steel with 1¼ to 1½ per cent carbon; file steel with 1 to 1.1 per cent carbon; scythe steel with 0.8 to 1 per cent carbon.

To follow the steps in the making of steel is not difficult.

The molten iron from the blast furnace is run into the pear shape vessel called the bessemer "converter." This vessel is lined with fire brick, and is provided with openings through which air can be forced into the iron.

The outward appearances of making iron into steel are as follows:

The air pump begins to blow air into the molten iron and at the nose of the vessel a small flame begins to burn. Air continues to be forced into the vessel and soon the moment comes when an orange yellow flame edged with blue, streams from the nose of the vessel. Still the air enters the molten mass and again the flame changes, a very bright flickering flame, with great streams of sparks, issues from the vessel.

At last the flame drops.

What do the flames mean?

The silicon and manganese begin to burn when the blast of air enters the molten metal, and when these two elements are burned off, the carbon begins to burn.

The flame tells the beginning and the ending of the burnings.

If the temperature rises too high while the silicon and manganese are burning, the carbon takes

fire and burns at the expense of the silicon and manganese, and these elements are left unburned in the metal to its undoing.

If the air is continued after the flame drops the iron in the vessel burns.

The man who operates the great fire belching vessel learned his lesson on the bridge. Experience has been his teacher; he has become a man of great genius for steel-making, he has learned what books cannot teach.

The silicon, manganese and carbon have burned off and left the molten iron characterless, and it is from this by additions of carbon and manganese that steels of all grades of hardness and toughness are to be made.

Maybe a batch of steel rails is needed for a spur line which will bring wheat from the farm to the big market, and to procure the steel a mixture of manganese and carbon is carefully weighed and added to the characterless iron to give it toughness with strength.

Again there is an order for steel to be made into wire fence. The weighed amount of manganese and carbon is added to another batch of characterless iron to produce a product which can be drawn out into long strands of wire, tough, strong and springy.

The Open Hearth Process

As the bessemer ores were becoming exhausted it became necessary to use the high phosphorus ores that could not be treated by the bessemer process of steel-making. Therefore a different process was demanded and hence the development of the open hearth.

The farm is mentioned. From the steel mill to the farm is not as long a jump as it may seem. A million tons of valuable phosphate slag, a half million tons of nitrogen, as sulphate of ammonia, each year go from the steel mill to the farm.

Again in this process there is the use of fire to tear iron from its baser companions and ennoble it as steel.

The means used are different, but the end is the same. Air is not blown through molten iron but over molten iron. Silicon and manganese and carbon burn up and off, but without the grand pyrotechnic display of the bessemer vessel.

On a shallow saucer shaped hearth, enclosed with fire brick, and called a furnace, is placed a layer of scrap iron, and on this a layer of pig iron.

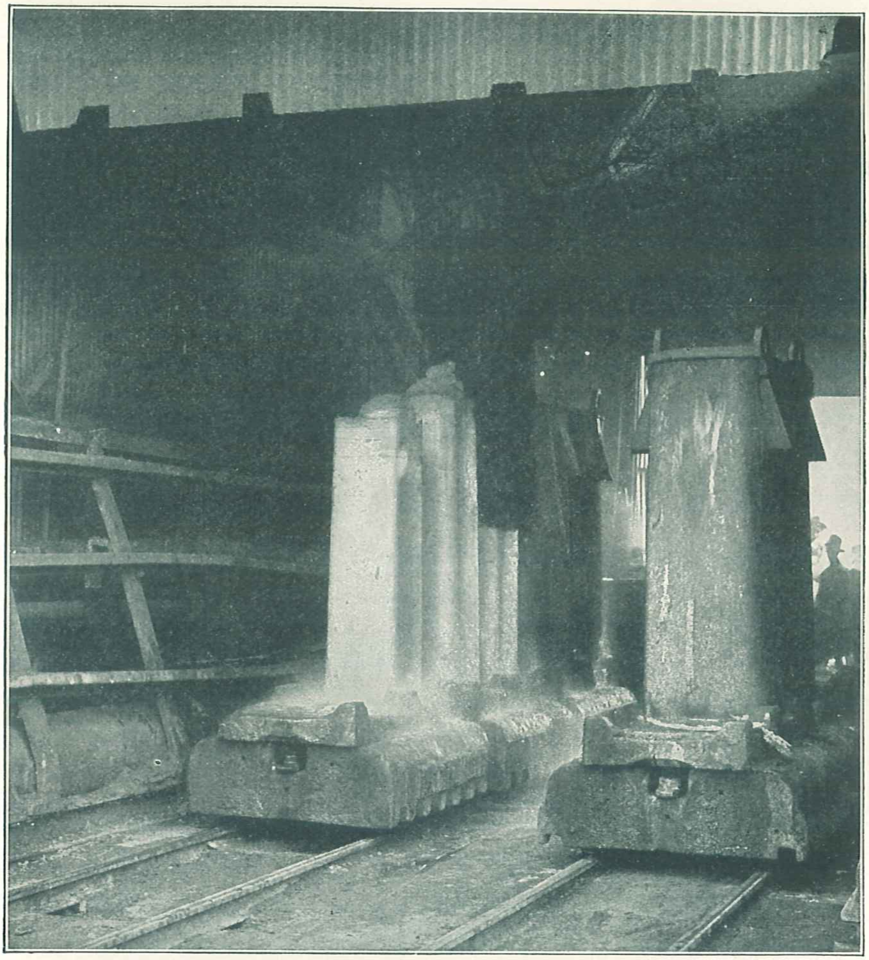
Open Hearth Process—blowing air over the top.

Hot gases are forced into the furnace and made to burn above and around the irons heaped on the hearth. The pig iron melts and runs down over the scrap iron and covers it. A cinder forms over all.

Silicon and manganese are first to burn off and then the carbon takes fire and burns. The result, as with the bessemer process, is characterless molten iron. To make this iron into steel weighed quantities of carbon and manganese are added, just the same as in the bessemer process.

Shaping Steel by Hot Rolling—Ingot to Rod

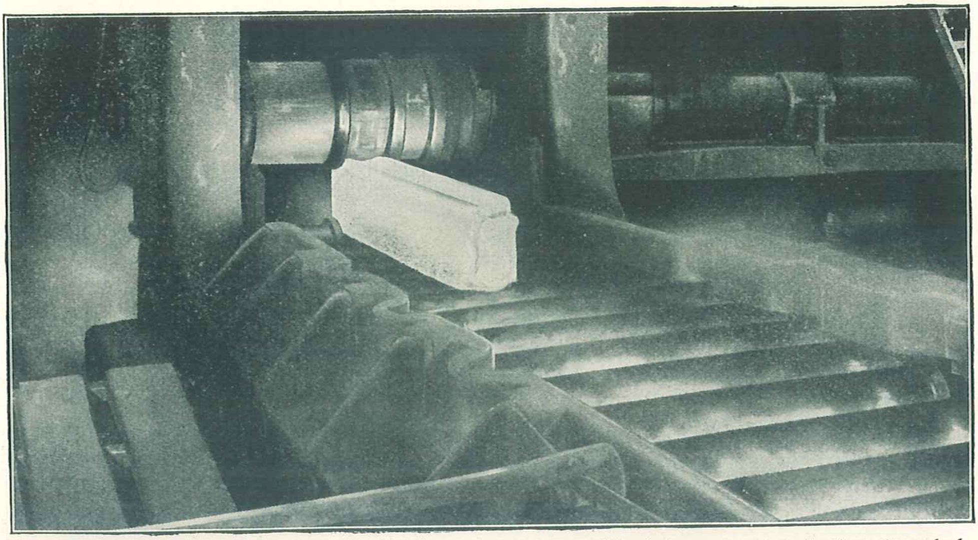
First Step in Shaping Steel, After Ingot is Poured at Furnace, is to Pass it While in White Hot State Through Shaping Rolls Until Reduced to Long, Round Strips, Size of Lead Pencil, Called Rods



The great white hot ingots weighing 5,000 pounds are placed on cars to be carried to a furnace where they are soaked through and through with heat preparatory to the first rolling. On the right the ingots are in their cast iron molds. On the left the ingots are shown with the molds stripped off after they had cooled sufficiently to stand alone. The ingots are poured into these molds that rest on cars so they are readily moved about.

FROM the ladle into which the bessemer and open hearth steel is being discharged as shown in illustrations in preceding pages, the ingot is cast in a steel mold. The ingot approximately is 18 inches square and about 5 to 6 feet high, and weighs about 5,000 pounds. After pouring, as described on previous page, to make the quality of the steel as uniform as possible throughout the ingot, it is put into a furnace called a "soaking pit," holding from 4 to 8 ingots at a time, and kept under a terrific heat for about 50 minutes or until the expert furnaceman judges by its color and appearance that it is "cooked" just right for rolling.

The ingot then is taken out of the soaking pit in a condition of white hot softness, that is, even throughout, and quickly passed to the rolling mill, where it is passed back and forth between rolls like clothes through a wringer. These rolls are made of either cast steel or cast iron. The shape desired is cast into the rolls as shown in the picture on page 62. Rolling back and forth, each time the rolls being closer together than before,



ROLLING MILL. Showing white hot ingot being passed back and forth between cast steel rolls until worked down to small size. Speed about 600 feet per minute. Each time the steel passes through the rolls the crystals are broken up into smaller sizes and held there with the cooling temperature. This cooling is not regular, even cooling, but is in three principal steps with a pause at each called "critical temperatures," until the final step is reached. By this time the man operating the rolls must not only have his steel rolled down to size of a billet, but the texture, crystals or grains must be broken up into finest sizes and finally fastened there by cooling the metal, at just above the last critical temperature.

the big ingot is turned over and over and soon is lengthened out and shaped as desired, being reduced in about a score of passes back and forth, from the size of the big ingot shown, to a long length of steel 4 inches square which is then cut up into 150-pound pieces about a yard in length, called billets. These are then passed to the rod mill as shown on the next page and rolled into rods from which wire is drawn.

ROLLING THE RODS. Billets are put into a furnace and brought to a white hot, pliable condition and then run through rod mill rolls. After running through the first set of coarse-grooved rolls they are switched back into another set of finer grooves and so looping back and forth, getting longer all the time, the last set of rolls finishes to the size wanted. The picture on next page was taken with mill in actual operation, and the fiery, red-hot rods are shown in long loops as they are switched around from one set of rolls to the other. As the metal is now reduced to small round metal strips, it naturally cools quicker and the operation of rolling is correspondingly quicker. The rods are sometimes run through at the rate of 3,000 feet per minute and are so quickly finished into bundles like the picture on page 63 that they are almost as red hot as at the beginning.

CLEANING THE RODS. In rolling the rods a slight scale of black substance forms upon the surface, such as frequently is seen on horseshoes. Before the process of wire drawing can be carried on, this black wire scale must be removed. The only practical way that has been found to do this is by means of diluted acid called a "pickling solution." The several bundles of rods shown in picture have just been immersed for a few moments in the pickling vat on the left. The scale has been eaten off by the acid and the rods are now being lowered into a tub of hot water to rinse off the acid. At this point they are also sometimes washed with a hose to further remove the acid.

The rods are then put through what is called the sulling process — that is, they are run very slowly under successive sprays of water, which, in combination with the slight traces of acid still upon the rod and the exposure to the atmosphere, form a coat of slightly greenish cast known as the "sull coat," which is absolutely necessary in the cold drawing process.

Having received the sull coat, the rods are now dipped in milk of lime for a three fold purpose. In the first place, the lime being an alkaline substance neutralizes any remaining traces of acid, in the second place, when this lime coat dries, giving the rods a whitewashed appearance, it protects the rod from further atmospheric action and lastly, the lime being a slippery substance like talcum powder, it helps to lubricate the rod as it is drawn through the steel die.

The rods, cleaned and prepared, are now ready to be drawn into wire.

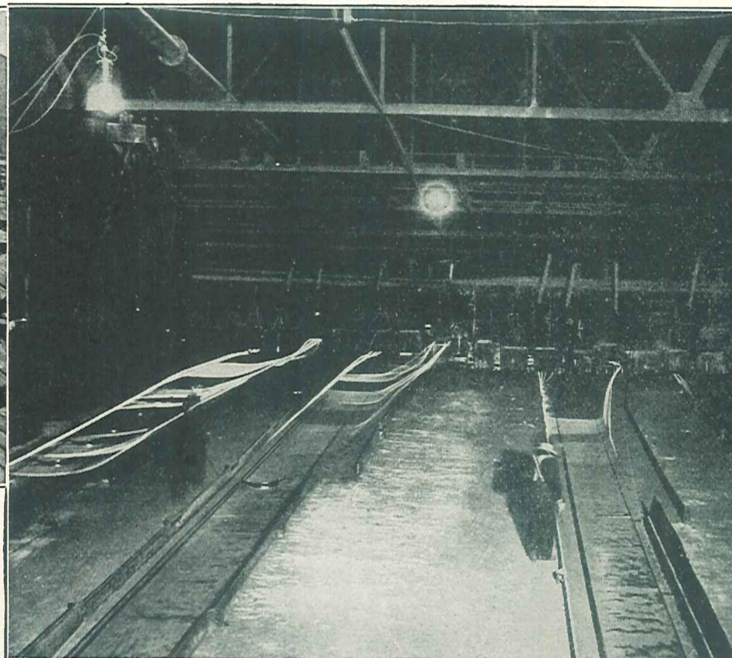
Sulphate of Iron

Sulphate of Iron (copperas) begins here, as the acid is neutralized and becomes a rich solution of iron, which later is passed through the chemical department and is converted into pure sulphate of iron, more commonly known as copperas.

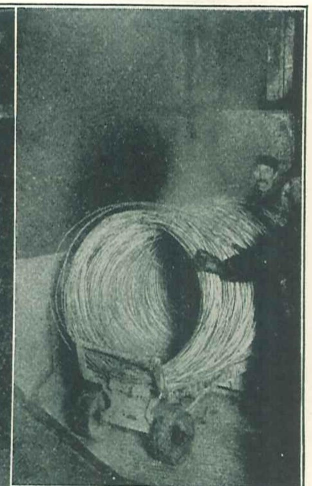
This sulphate is valuable for killing weeds, is very effectual in the prevention of hog cholera, is a worm expeller and blood purifier and general tonic for live stock; a cleaner of poultry houses,

Billets

Rolled down to 4 in. square by 1 yard long, weighing about 150 lbs. each. Also made in other sizes. These billets now are ready for the last operation of the rolling process by being rolled into rods.



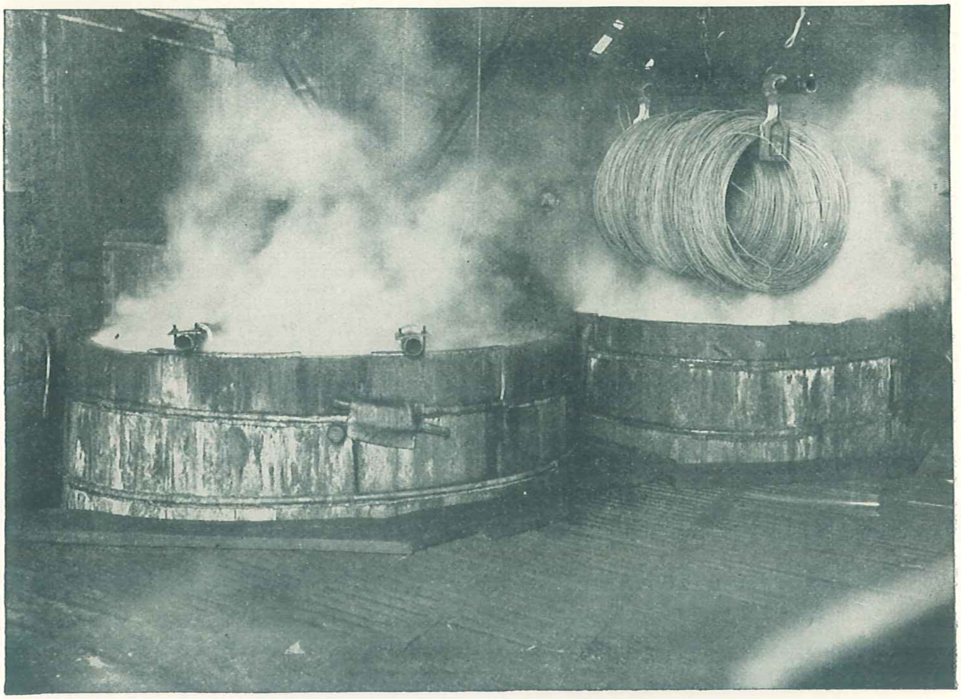
A Rod Mill in operation, reducing a billet to lead-pencil size rods. The light colored lines show the white hot rods as they are looping around from one set of rolls to another.



Rods

The billet is heated white hot and rolled into long, round strips about the size of a lead pencil, called rods. Most common gauge is No. 5. A bundle of rods represents one billet. This ends the rolling mill process. From now on this metal is drawn down to shape while cold, by the wire drawing process.

barns and hog lots by preventing parasites, flies and insects. Is put up in 25-lb. cartons and larger packages and sold at very low cost by fence dealers, where our special literature on the subject may be obtained. This sulphate is also used in the purification of the water of cities, such as St. Louis, Cincinnati, and a hundred other cities.

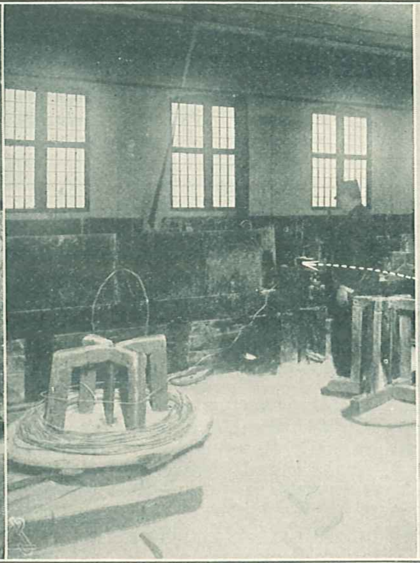


Tubs for cleaning rods before drawing into wire. Bundles of rods have been dipped into diluted sulphuric acid in tub on left and are now shown being dipped into tub of hot water to wash off acid.

Steel Rods Cold Drawn into Wire

The Wire Process Now Begins With the Rod by Drawing Cold Through Dies Until Reduced to Size of Wire Desired

Baking Oven
Bundles of lime coated rods about to be put into the oven to overcome brittleness.



Wire Drawing
A bundle of lime coated rods being drawn from reel through die and made into wire.

Wire Drawing Die
Steel dies are used on all shape wire, all very large wire and fine drawn wire. The holes in steel dies for shape wire are hot punched, tapered and shaped up through a solid piece of steel. For very fine and high duty wires we frequently use diamond dies. In the construction of diamond dies a small crystal of diamond is set into the entire outer opening of a small circular disc of metal, then a hole of the required diameter is worked through this diamond by means of special drills and diamond dust. Diamond is one of the hardest known substances and has great wearing qualities.

Annealing and Drawing Wire

THE lime coated rods are now put in an oven and baked for several hours at a temperature of about 400 degrees, and then allowed to cool down slowly. This is called baking, and is done to remove the brittleness of the wire.

The middle picture shows the actual operation of drawing wire. At the right is a picture of a die. This die is clamped in a vise shown in front of the man in the picture.

The reel at the left shows a bundle of lime coated rods; and as the end of the rod is pulled through the die, it is fastened to a revolving drum that pulls the entire length of the rod through the die. The rod is not exactly round in shape although approximately so. But after it is drawn through the die and becomes wire, it is round and smooth and without kinks.

The drawing process continues, the wire being drawn through one die after another, each one smaller than the one before, until reduced to the required size.

It takes careful watching to keep the dies in proper condition. When they are worn the holes are closed up and carefully punched out again to the proper size. With each draft of the wire through a smaller hole, the wire is not only made smaller in diameter and longer in length, but it is made harder as well, because the steel is packed together more tightly as it passes through the die.

If the drawing process were continued long enough the wire would become quite brittle. It is therefore necessary to stop drawing and run the bundles of wire through the oven and anneal it to make it soft. This process enables the crystals of the steel to assume a more uniform and normal condition with respect to each other, thereby reducing to a minimum all local tension or strain from previous heating or working. It is the only way to make steel wire soft and ductile.

This wire made hard by the drawing process and for want of annealing is often mistaken for and sometimes called "coiled steel spring wire" or "steel spring wire," when it is really nothing but wire which has gained its hardness or springy qualities from the drawing process.

Some fence makers claim that the hard wire is of better quality and more expensive than soft wire. Exactly the reverse is the case, because the soft wire has undergone the considerable expense of reheating in the annealing oven to readjust the crystals.

An ideal fence wire is one that is only as hard or as stiff as will permit of ready splicing in the field. Hard drawn wire, therefore, is less expensive than soft.

Overheating and Burning Steel

OVERHEATING AND BURNING STEEL result when steel or iron has been heated to a very high temperature which is respectively moderately close and very close to the melting point. Both these effects are frequently termed overheating, but this should be avoided. In overheating, the crystals are rendered very coarse, and the cohesion between the crystals is lessened so the metal is tender. The normal condition can be restored by heat refining alone, or better, in combination with mechanical working. In burning, the condition may range from extreme overheating to where the more fusible constituents melt and run out from between the crystals, giving rise to a shower of brilliant sparks. The former condition can probably, at least partially, be corrected by heat treatment and mechanical working, but steel in the latter condition is hopelessly ruined and is fit only to be remelted and is said to be oxygenated.

— *From Tiemann's Pocket Encyclopedia of Iron and Steel.*

A blacksmith heats his metal to the welding temperature to make his weld. After this he works over the metal and again returns it to the fire at a much lower temperature to reduce the size of the crystals, in this respect following the practice of the rolling mill as described under picture of rolling mill on page 62. A blacksmith knows that without subsequent reworking and reheating, the steel would be brittle. A practical blacksmith, therefore, has learned by experience what the science of steel making has discovered, and as set forth by Tiemann in the above.

Lessons in Wire Making Revealed by Microscope

Showing How the Desired Structure of Steel is Obtained by Proper Manufacturing Processes

IN the last fifteen years the microscope has been impressed by the steel maker and with wonderful medical results. It has sounded the death knell of the "rule of thumb" practice, and made it possible to know steel.

The microscopic work on steel has demonstrated that steel primarily is a crystalline mass

Fig. 1. Section of Annealed Steel, polished and etched, showing structure.

of iron and a compound made up of iron and carbon.

The compound of iron and carbon in its pure state is extremely hard and brittle and for this reason is without commercial use. But when alloyed with a larger amount of iron to make steel, this compound gives to steel those valuable properties which distinguish steel so strongly from wrought iron.

If a piece of annealed low carbon steel be polished and etched with nitric acid and viewed under the microscope, it will reveal a structure similar to that shown in Fig. 1. This photo-

Fig. 2. Properly annealed sample of .45 per cent carbon steel, which has been restored from the condition referred to in Fig. 8.

graph shows in the white portion the crystals of practically pure iron, while the carbon-containing constituent appears in the form of a black network around those crystals. Other important chemical constituents besides the carbon are of course present in the steel. The most important of these are phosphorus, silicon, sulphur and manganese. But these are combined with the steel in such manner as not to appear under the microscope and are of minor importance so far as the steel is concerned structurally although of course each of these elements exerts its beneficial or harmful effect on the physical properties of the steel.

What takes place when this soft steel is subjected to the hardening process of wire drawing?

Fig. 1 shows an annealed low carbon steel previous to wire drawing. The important feature to notice is that the crystals are arranged in a comparatively symmetrical manner.

Fig. 4 shows the same wire after having been drawn once through the die. This photograph

Fig. 4. Same wire drawn once through the die—crystals elongated in direction of drawing, but keeping original area.

was taken of a polished and etched section of the wire in such manner as to show the direction of the drawing, and it will be noted that the crystals have become elongated in the direction of drawing, each crystal keeping its original area, but its dimensions have been changed by the drafting process.

Fig. 5 shows the same wire after drawing a number of times through the die and the extreme elongation of the crystals in the direction of the drawing is plainly evident. The extreme drawing has, however, more or less obliterated the original boundary lines between the crystals, and the whole mass of metal has been so distorted and strained that it has in a measure lost its ductility, although it possesses the high tensile strength characteristic of a hard drawn wire.

Such wire after many drawings has lost so much of its ductility as to be unfit for further drawing, but if this wire now be annealed at suitably high temperature, the strain-distorted crystals will rearrange themselves in a symmetrical manner, as shown in Fig. 6.

Fig. 5. Same wire after a number of drawings, with extreme elongation of crystals and obliteration of original boundary lines.

It is evident that the strained condition to which the high tensile strength and loss of ductility was due has been removed by the annealing process, and the wire after annealing is in practically the same condition that it was in before the drawings were performed.

This illustrates the benefits of annealing in producing the very small sizes of wire. By annealing at proper temperatures it is possible in the same manner to refine the crystals of any steel whether hard or soft.

Fig. 6. Wire after many drawings loses much of its ductility, but when annealed at suitable high temperature, strain-distorted crystals rearrange themselves as shown.

Fig. 8 shows crystals of a steel containing .45 per cent carbon. This steel was made coarse and consequently brittle by undue overheating. It can be restored to a desirable tough structure by proper annealing. Such a properly annealed sample is shown in Fig. 2.

Similarly Fig. 9 shows coarse crystals and consequently brittle low carbon steel wire. In this coarse and brittle metal the steel is not safe for most commercial uses, but by proper annealing it can be restored to fine crystals and tough metal as shown in Fig. 1.

Fig. 7. Conditions of ordinary annealed steel containing 90-100 per cent carbon. Steel comparatively soft, of low strength and high ductility.

Heat Treatments

Wonderful properties may be imparted to steel by heat treatment, and by heat treatment is meant those various operations of heating and cooling which are given to steel to produce or develop certain definite properties which are desired.

A cold chisel is given the desired temper by plunging it red hot into water and then reheating (tempering) to a blue color.

A high carbon wire is given the desired temper by plunging it red hot into oil or molten lead and then reheating (tempering) in molten lead which is held at exact temperatures.

By heat treatment it is possible to control the properties of the steel in the most flexible and wonderful manner.

Fig. 7 shows the conditions of an ordinary annealed steel containing .90 per cent carbon. This photograph is taken at an extremely high magnification ten times more than the other illustrations. In this condition the steel is comparatively soft, of low strength and of high ductility. If this steel be heat treated by proper means it can be made to have a structure similar to that shown in Fig. 11, in which condition the steel is much harder, of high tensile strength, of great toughness, but at the expense of a certain amount of ductility as compared with the annealed steel shown in Fig. 7. The heat treated structure shown in Fig. 11 is for many practical purposes so much more desirable, that the slight loss in ductility is more than compensated for in the great gain in other valuable properties.

Fig. 8. Crystals of a steel containing .45 per cent carbon made coarse by overheating.

This remarkable combination of strength and extreme toughness is best illustrated by our piano wire. A sample of this is shown in Fig. 12. This wire has a tensile strength of 375,000 pounds per square inch. This strength is six times that of the steel used in the ordinary steel beam used in skyscrapers; and the steel for skyscrapers is the same as we put into our fences, as the requirements for tensile strength and ductility have been found by long experience to be about he same. In spite of this enormous strength the wire is sufficiently tough to wrap around itself as shown in Fig. 12, and tough enough to allow it to be hammered flat to about one-third of the original diameter of the wire, as shown in the photograph.

Fig. 9. Coarse crystals and consequent brittle low carbon steel wire, a steel not safe for most commercial uses, without reheating.

This hammering flat is accomplished without cracking or splitting the metal and without losing its tensile strength. This remarkable combination of strength and toughness is made possible only by the most careful and accurate heat treatment controlled by sensitive heat measuring

instruments and by the use of the highest qualities of material.

This same steel containing .90 per cent carbon is similar to that used for steel to hold cutting edges, such as cold chisels, pocket knives and other cutlery. And when it is considered that steel of this character and carbon can, by heat-treatment, be made to combine with its enormous strength such high ductility, we appreciate the wonderful advance which scientific heat-treatment has made in the art of making steel

Fig. 11. Heat-treated structure shown here is so much more desirable that slight loss in ductility is overbalanced by gain in other properties.

to fit the most exacting requirements of modern demands.

Such enormously high strength cannot of course, be secured without some sacrifice of ductility, and it is only possible to use such material in places where the ductility is not essential as, for instance, in our piano wire. For wire rope it would not be safe to risk men's lives on a wire which lacked the ductility to the extent of piano wire. But by the proper heat treatment we can secure the amount of ductility far in excess of the actual demands of safety combined with the high tensile strength so important in a wire rope. That is, the combination of heat treatments most desirable for piano wire are not the treatments most desirable for rope wire. And by careful selection of different grades of steel, the finished material will be given those properties which are the most desirable for the particular work the steel is designed to do. For a fence wire, for instance, which is subject to accidents and where it is necessary that the fence yield rather than break, it

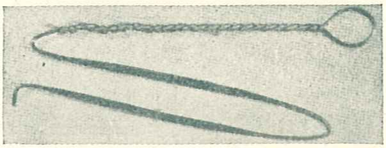


Fig. 12. Sample of piano wire, with tensile strength of 375,000 pounds per square inch, 6 times that of steel used in ordinary steel beam.

is desirable to make a further sacrifice of tensile strength in order to attain the high degree of ductility found by experience to be desirable for a fence.

Here again the principle of selection of different grades of steel is an all-important factor in the manufacture of perfect wire for fence, and only by a knowledge of these fundamental principles gained by years of experience and experiment are we able to determine and use just that combination of the different grades of steel which is most desirable.

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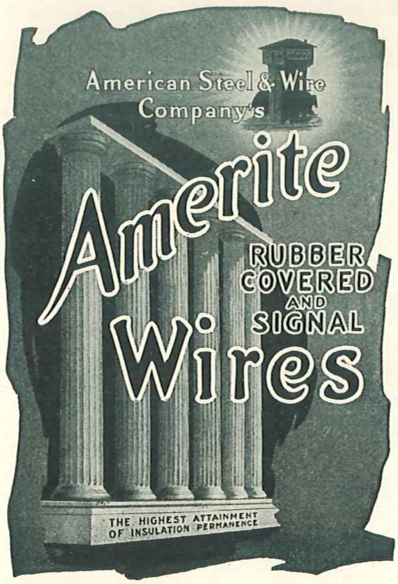

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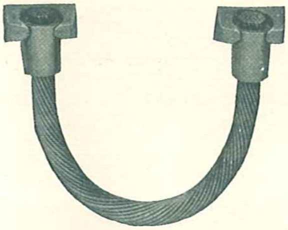
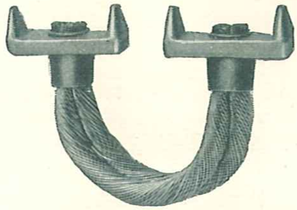

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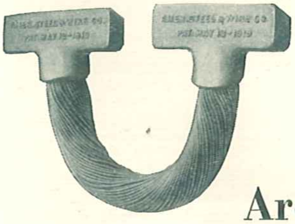
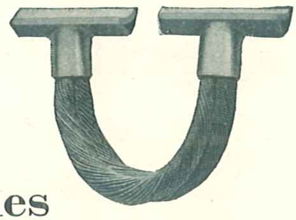

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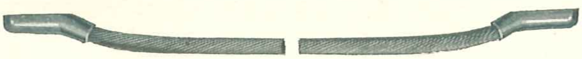

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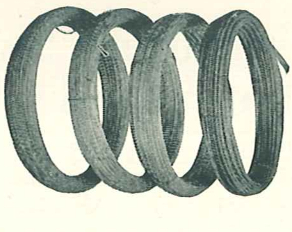

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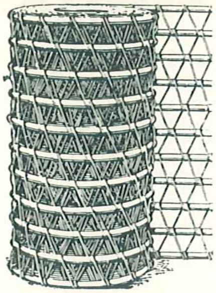

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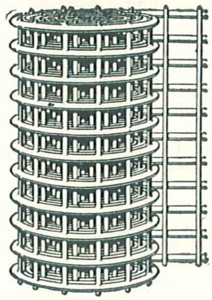
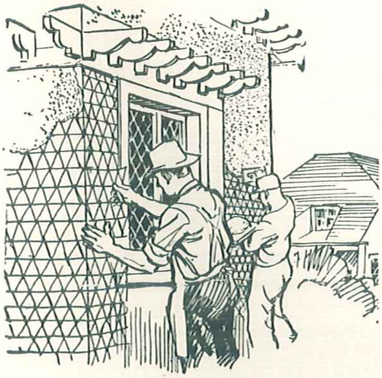


Stucco Reinforcement



Galvanized Steel Fabric Reinforcing with its many angles of wire not only grips the cement tight, but reinforces it also, the principle being the same as reinforced concrete now used so extensively.

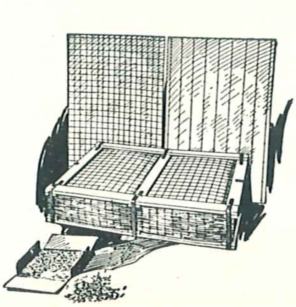
With its many galvanized steel wires imbedded in the cement, the wall becomes one unit—one solid mass of cement wall. That is what makes stucco strong and durable.

Perfected

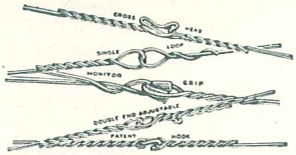
Plaster Stucco Reinforcement

The modern plaster base and reinforcement. A combined lath, reinforcement and base for plaster, cement and stucco. An electric welded mesh of cold drawn galvanized steel wire which is backed by tough waterproof kraft paper. Plasters quickly and without effort.

Send for free literature fully describing.



American Bale Ties

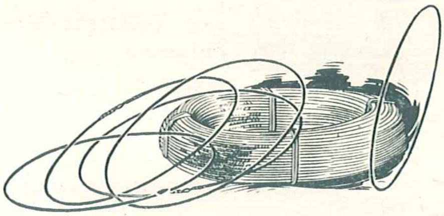


MUCH depends upon the strength and reliability of a bale tie. Heavy commercial loss results from the use of ties of unproven worth. No other form of wire calls for more care in manufacture, beginning with the earliest stages of steelmaking down to the finished tie—no other form of wire has to stand more strain and abuse. Bale tie wire MUST be made in the highest perfection possible — anything less invites heavy damage and loss.

American Bale Ties have been tried for more than 26 years in actual use. Today they are standard of the world.

Complete Descriptive Catalogue sent free for the asking

American Wire Hoops



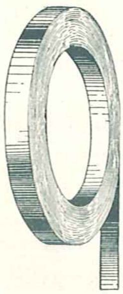
The Twisted Splice Wire Hoop is produced by forming a circle of proper dimension, cutting the wire to length and twisting both ends together after having lapped a sufficient distance to make the twist, twisting from the center. The care used in the manufacture results in a perfectly spliced hoop, having a smooth twist and close lay of the ends. Used for slack cooperage.

The American Electric Welded Wire Hoop is manufactured of a special quality of steel, the composition of which renders it adaptable for welding.

The wire is cut to the necessary length and the two blunt ends are brought together and welded electrically, forming what is termed a "butt" weld.

Suitable for woodenware packages having a smooth surface where it is desirable to use a hoop which will not disfigure the surface by driving, such as butter, lard and wash tubs and candy pails.

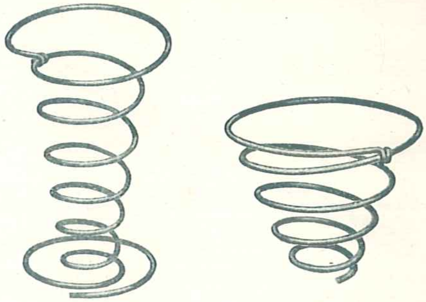
Flat Wire Cold Rolled Steel



IN all widths up to 26 inches, for shaping into all forms of manufacture in automatic machines or otherwise, such as butts, hinges, tubes, roller skates, keys, typewriter, sewing, adding machines, and automobile parts, cream separator discs, buttons, stove and show case trimmings, gun parts, wire chair rims, go-cart parts and any difficult or plain forming where flat steel of great ductility, strength, finish and uniformity are required.

"Flat Wire Bulletin" mailed free.

American Springs



We manufacture wire springs of every variety and for all purposes.

Clock

Motor

Furniture

Agricultural

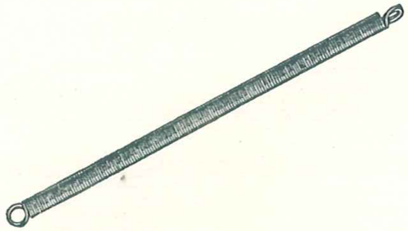
Automobile

Fine and Heavy Springs of all kinds.

Services of our engineering department, free.

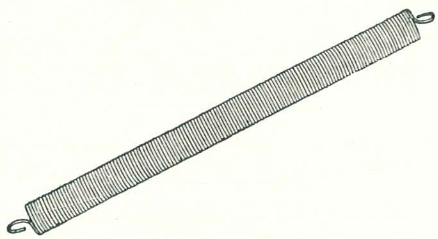
Send for complete springs catalogues—free.

Perfection *Door and Gate* Springs



Double Wire Loop Ends

The best steel is used in the manufacture of these springs, ensuring permanent resiliency and freedom from breakage. A cheap yet perfect spring for screen doors or other doors—easily applied with simply two screw hooks.



Hook Ends

Made of best steel. A strong spring to keep the gate closed. Simple and easy to apply.

American Piano Wire

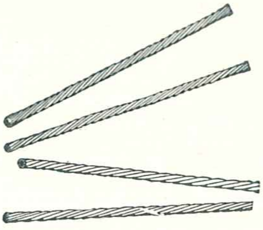
PERFECTED CROWN

Highest Acoustic excellence dating back to the days of Jonas Chickering. Took prize over whole world at Paris, 1900. For generations the standard and used on the greatest number of pianos in the world

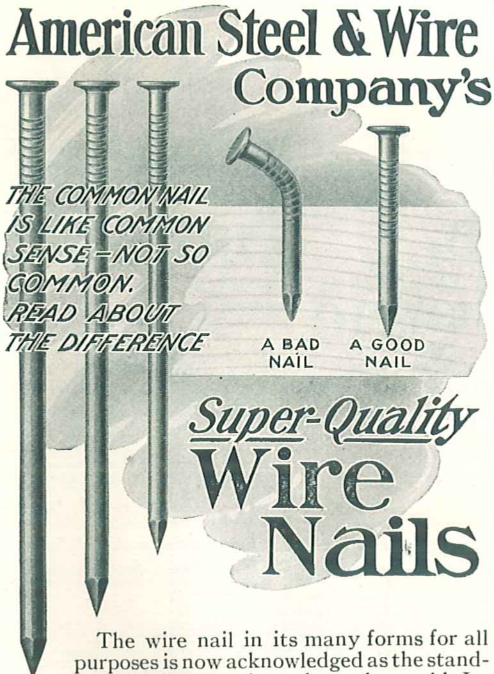
Services of our Acoustic Engineer always available—free.

Illustrated books—free.

American Wire Clothes Lines



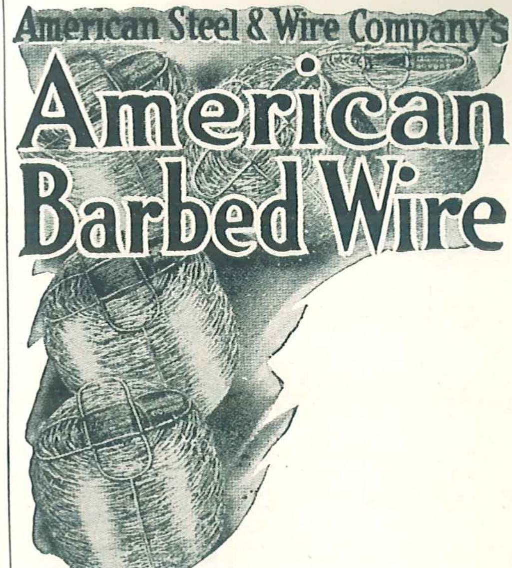
Heavily coated with Zinc Smelter to withstand the effects of atmospheric conditions. Can be stretched permanently from post to post and will last for years. Eliminates trouble of taking down each wash day. Easily cleaned with a rag dampened with kerosene.



The wire nail in its many forms for all purposes is now acknowledged as the standard of nail usage throughout the world. Its remarkable adaptation to many uses and its rugged efficiency has tended to avoid, with many people, any thought of discrimination in its manufacture. Yet there is as much difference in the care employed in making wire nails as in anything else that is made by machinery. The cost of nails is usually the lowest item on a job, due to the economies of large wire production.

The primary value of a nail is in the quality of the steel and in the perfect drawing of the wire, then in the shaping of the head and the cutting of the point. Where the hard steel quality is used in the wire, which is most requisite and necessary for the stiffness of the nail, the shaping of the head and the cutting of the point is naturally difficult and expensive; which if a softer quality of steel is used, it is easier and cheaper. Hence the basic merit of the nail is least apparent on sight—it is hidden in the sturdy character of the hard steel that is demonstrated only in driving. There is real economy in buying this quality as the softer quality may spoil a job and the consequent damage done makes it high at any price.

The heads and points of our nails are shaped from the hard, sturdy steel, by the most deft machinery, under the keen supervising eye of inspectors. Study an American Steel & Wire Company's nail, note the clean, sharp point, the firm set head showing ample metal, the well punched barbing, the accurate gauge, and above all test that which does not appear at first glance —the great strength of the steel that holds straight in driving according to the work for which intended. And further, our nails are packed full weight, 100 pounds net, in each keg.



WE are the originators of barbed wire, and our mills making it today are the same ones first employed to produce it. Barbed wire is one of the most practical of inventions and its claim for extensive usage is based upon its utility, low cost and durability.

All brands of barbed wire made by us are plainly stenciled with the brand and registered trade marks. Customers who want good quality should insist on getting our well-known brands. Our motto is "KEEP UP THE QUALITY."

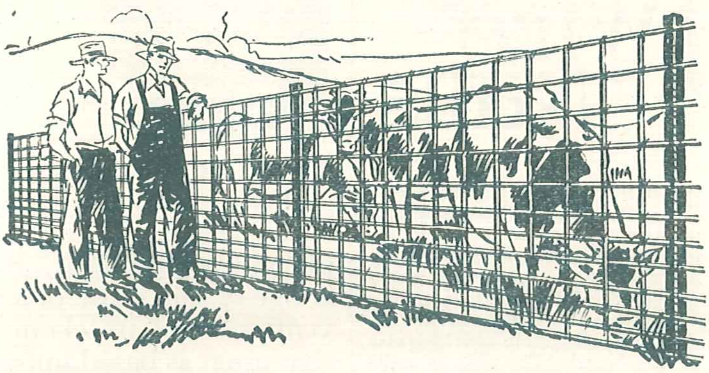
Made in the following standard brands:

American Glidden
Ellwood Glidden
Baker Perfect
Waukegan 2-point
Lyman 4-point
Waukegan 4-point
American Special 2-point.

Catalogue on request.

Zinc Insulated
Trade Mark

American Royal Anthony Monitor U.S. National and Prairie Woven Wire Fences



Guarantee of Service

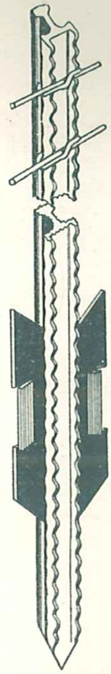
That these fences will give you the equal of or longer service than any other fence made of equal size wires and used under the same conditions. Any buyer who shows that they fail to do so will upon presentation of the written guarantee, be supplied with an equal amount of new fence free.

These fences have always been the highest quality fences that the most progressive methods of manufacture could produce. Improvements constantly are added as discovered to make them last longer and give better serve.

Dealers Everywhere ***Send for Illustrated Catalogues***

Banner Posts

R. R. RAIL SECTION STEEL



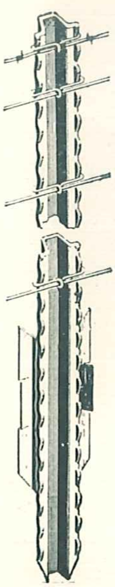
The Post with a Backbone

Banner Posts with their railroad rail design and large slit-wing patented anchor plates, root firmly into the ground, hold the fence securely in line and give many years of service. Notches frequent enough to fasten every line wire. Seven Banner wire clamps are furnished free with each post.

Furnished in light gray painted or galvanized.

Ideal Posts

U TYPE STEEL FENCE



Made from new steel rolled into a channel or trough section, commonly called a "U." This type of section has long been used in ships and bridges and in its modified form it makes an unusually attractive fence post both from standpoint of strength and appearance. The posts are rolled in our own mills from specially selected steel which is exactly right for the purpose.

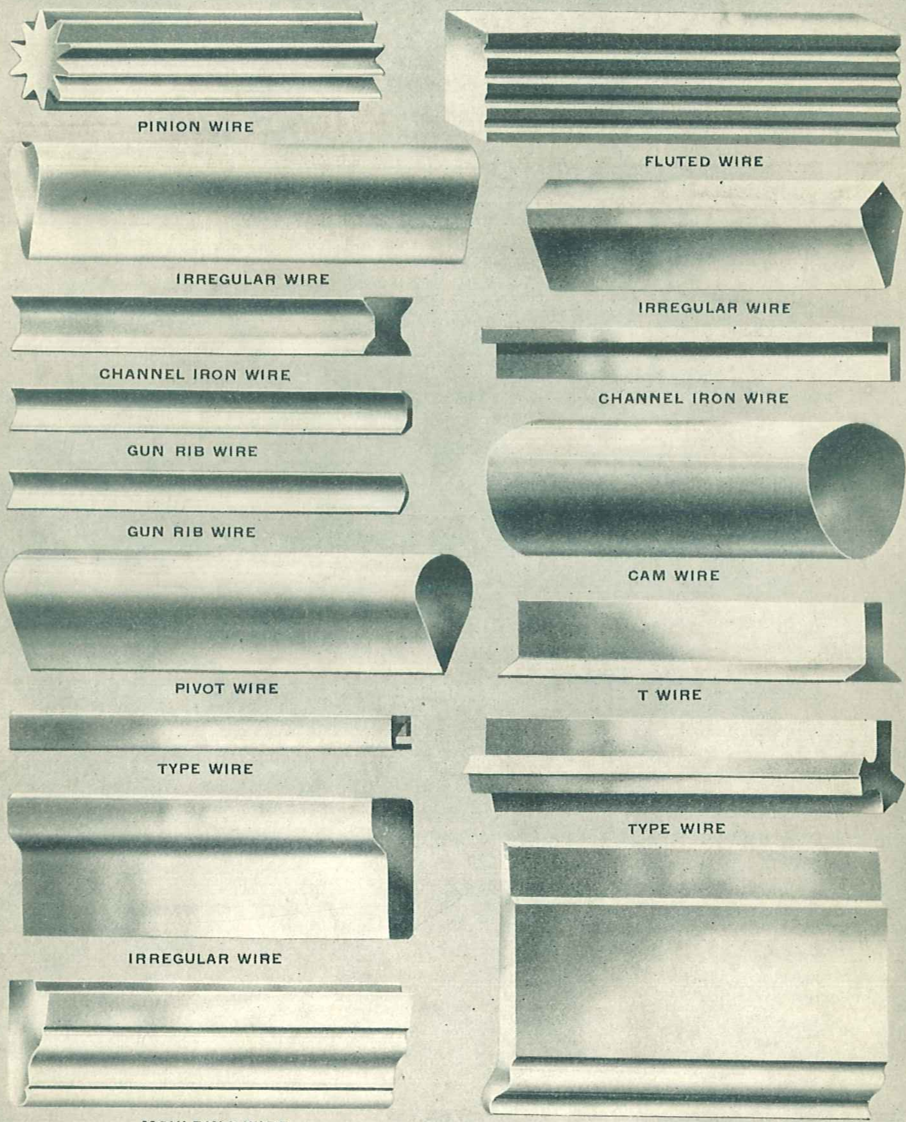
Large anchor plate—increased ground facing does away with the shearing point.

Fence easily stretched and held in place by special loop clamps, seven of which are furnished free with each post.

Painted willow green, baked on under high temperature.

American Steel & Wire Company

A few examples of different shapes of
wire drawn for the manufacturing trade.



WIRE DRAWN INTO ALMOST EVERY SHAPE FOR MANUFACTURING PURPOSES